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The Impact of Culture on Crisis Management in Complex Settings - A Case Study of Fukushima

B. Sc. Thesis
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Abstract

This study aims at answering the question to what extent and how the cultural context of Japan affected the adequacy of crisis management concerning the meltdown of the Fukushima nuclear reactor after the tsunami in 2011. Realistic Evaluation and causal-process tracing allow for the detection of mechanisms that drove the crisis management in Japan. These mechanisms are represented by the additional variables *level of politicization*, *geopolitical context*, *improvisation from protocol*, and *interagency collaboration* that are all presumed to affect adequacy of crisis management. A document analysis of qualitative data (official evaluation reports, secondary literature, Japanese and international newspaper articles and press releases, official statements from international and Japanese politicians) discloses that the actors involved in the crisis management already failed at preparatory stages. As no real emergency plan was at work, the management of the crisis was fully improvised. The intended interagency collaboration resulted in a chaotic situation in which each actor acted independently. This led to great confusion among society which, along with intentional manipulation of the media by the Japanese government, rendered politicization within and beyond Japan's borders impossible. Criticism on the inadequate crisis management was thus missing. All these findings contribute to the verification of the hypothesis that the cultural background of a country indeed influences crisis management – during the Fukushima crisis it occurred in a negative way.

Keywords: Fukushima, Japan, crisis management, politicization, geopolitical implications, interagency collaboration, emergency protocols, cultural index

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Frequently Used Abbreviations

BWR	Boiling Water Reactor
ERC	Emergency Response Center
EU	European Union
IAEA	International Atomic Energy Agency
INES	International Nuclear and Radiological Event Scale
JAEA	Japan Atomic Energy Agency
JMA	Japan Meteorological Agency
JNES	Japan Nuclear Energy Safety Organization
JCNER	Joint Council for Nuclear Emergency Response
MAFF	Ministry for Agriculture, Forestry and Fishery
METI	Ministry for Economy, Trade and Industry
MEXT	Ministry for Education, Culture, Sports, Science and Technology
MHLW	Ministry for Health, Labor and Welfare
MOD (SDF)	Ministry for Defense (Self-Defense Force)
MOE	Ministry for Environment
MOFA	Ministry for Foreign Affairs
NEPHQ	Nuclear Emergency Preparedness Headquarters
NERHQ	Nuclear Emergency Response Headquarters
NIRS	National Institute for Radiological Sciences
NISA	Nuclear and Industrial Safety Agency
NPS	Nuclear Power Station
NSC	Nuclear Safety Commission
PCV	Primary Containment Vessel
TEPCO	Tokyo Electric Power Company Inc.
UN	United Nations
USA	United States of America
WHO	World Health Organization

1 Introduction

1.1 The Significance of Nuclear Energy in Research

The safety of nuclear energy power plants is an everlasting issue on the agendas of decision-makers. After the Chernobyl crisis in 1986 politicians and the public started to seriously consider to phase-out nuclear energy or, at least, develop sustainable alternatives. Several institutional bodies were established to monitor and control the safety of nuclear power plants, to assess the risks for humanity and the environment, and to adjust national and international legal regulations. Research on crisis response to nuclear disasters became prominent after the Chernobyl accident, especially in terms of the apparent lack of adequate crisis management. Scientists raised awareness that nuclear energy disasters can have such destructive consequences that it has to be dealt with much more critically.

The aim of the research in crisis management in general is to identify problems and challenges arising during emergencies and to provide policy-makers with appropriate tools to solve them. One of the major works by Boin et al. (2005) offers a comprehensive framework helping to understand how leaders might react to crises, which challenges leadership faces and how decisions are taken in complex settings. This work serves as a great theoretical basis for studies destined to explain possible divergences between theory and practice.
Another seminal work in the analysis of crisis management by Allison and Zelikow (1999) elucidates three different models ought to explain the behavior of responsible bodies of crisis management and the characteristics of crisis management. Allison and Zelikow (1999) teach not to treat the government as an individual with purposive decisions but rather as a crisis management network in order to avoid false simplifications of the complexity of crisis management. Moreover, it facilitates the understanding of „what we see and judge to be important and accept as adequate depends not only on the evidence available but also on the ‚conceptual lenses' through which we look at the evidence" (Allison & Zelikow 1999: p. 2). Pawson and Tilley further argue that „[t]he reception of the ideas will […] depend on the cultural, social, and economic circumstances in which the patrols are embedded" (Pawson & Tilley 1997: p. 64).

The study of the influence of national and international context on crisis management in nuclear disasters is the main contribution of this research. Pearson and Clair (1998) raise awareness of the fact that theoretical concepts (such as those outlined above) and organizational processes underlie a certain understanding of politics and a specific cultural background. All studies being conducted in either European or American contexts which naturally are influenced by Western values, culture and education. Consequently, scholars start their research from a particular perspective on governance. This becomes particularly evident in the literature on nuclear energy crises. Sweden (e.g. Nohrstedt 2008),

Ukraine (e.g. Czada 1990), France (e.g. Jasper 2014) and Belgium (e.g. Kunsch & Friesewinkel 2014) often serve as (Western) countries of interest. Only rarely studies have been conducted on crisis response to nuclear disasters in Asia. This is the main motivation for this study.

1.2 The Cultural Dimension of Nuclear Crisis Management

The present thesis analyzes how Japanese decision-makers responded to the meltdown of the Fukushima nuclear reactor in 2011 and what impact politicization had. In this research, politicization is understood rather as a process than as a variable since it comprises societal contestation within Japan's boundaries and abroad as one dimension just like political decision-making as another dimension, in which media and mediatization play a role. This will be further conceptualized in Chapter 2.

The case of Japan is a contrasting case, offering a very different cultural and political perspective on the existing research on nuclear energy disasters. Scholars stress the challenges that culture and institutions bring along in the process of crisis management ('t Hart 2013). Geert Hofstede designed a model which allows for cultural categorizations of prevalent values at the workplace in specific countries and facilitates the analysis of such. This 6-D Model (Hofstede et al. 2010) consists of six dimensions: the power distance index, individualism versus collectivism, masculinity versus femininity, uncertainty avoidance index, long term orientation versus short term normative orientation, and finally indulgence versus restraint by which means a cultural categorization is made possible. This model helps understanding how the cultural background which deviates from several Western countries in many respects, as for instance the strong masculine imprint at work and the strict adherence to and deep acceptance of hierarchical relations, affected the crisis management after the occurrence of the Fukushima nuclear accident. These examples highlight the significance of taking into account the cultural background of Japan.

The inclusion of the cultural dimension of crisis management might lead to a reconsideration of existing theories on the adequacy of crisis management after the present study in an Asian context will have been conducted. Possibly, theoretical concepts developed by scholars of crisis management (Boin et al. 2005; Allison and Zelikow 1999) will no longer hold for non-Western nations since prevailing social conditions and the social context turn out to indeed matter and decide on the success or failure of actions by „[setting] limits on the efficacy of program mechanisms" (Pawson & Tilley 1997: p. 70). This could clear the way for *intercultural theories* that are applicable to crisis management in very different cultural contexts.

1.3 Research Question

By means of the above outlined framework, one arrives at the main research question:

To what extent and how did the cultural context of Japan affect the adequacy of crisis management concerning the meltdown of the Fukushima nuclear reactor after the tsunami in 2011?

The purpose of this explanatory research question is to reveal causes for whether or not the crisis management in Fukushima was adequate, and to further examine the effects of detected causes.
In general, this research tries to explain a phenomenon at the implementation and ex post choice evaluation stages within a decision-making process that allows for drawing conclusions for future crisis management.

To further one's understanding of the crisis additional explanatory variables are incorporated in the study, which are combined in the following sub-questions:
How did (a) the level of politicization, (b) the geo-political context, (c) improvisation from protocols, and (d) the level of interagency collaboration affect (moderate) the adequacy of crisis management in the context of Japan's specific cultural setting?

It is assumed that explanatory variables (a), (b), (c), and (d) have moderating effects; either exclusively on the dependent variable *adequacy of crisis management*, or on the relation between the process of politicization and the crisis management.

1.4 Outline of the study

Following the introductory section, the subsequent chapter provides five hypotheses underlying this study concerning the assumed relations between the explanatory variables and the dependent variable on the basis of theory. In a next step, it will be clarified how to go about to test these hypotheses in order to be able to draw conclusions. This comprises the explanation of the utilized research design, the case selection and sampling, the operationalization and data collection, and finally the data analysis. A case description will follow, providing all relevant information about the case Japan to facilitate the understanding of the study. On the basis of the gained insights in the case, an analysis will be conducted by testing whether the hypothesized relations from Chapter 2 can be traced back to the data, or not. The final chapter draws conclusions and gives an overview of limitations of the study by whose virtue recommendations for future research will be made.

2 Theory

2.1 Conceptualization of the Term *Adequacy of Crisis Management*

In order to address the research question, the following section first conceptualizes the term *crisis* before discussing the most important theories that aim to explain how, and under which circumstances, crisis management turns out to be successful and adequate.

Boin et al. (2005, p. 2) define a *crisis* as "a phase of disorder in the seemingly normal development of a system". Such disorder has the potential to threaten core values of the affected society which makes a crisis even more urgent if the level of uncertainty within the population grows. The risk for policy-makers during response operations and decision-making in such an urgent and uncertain environment is the unavailability of „essential information about causes and consequences" (ibid. p. 4).
Koppenjan et al. (2004) approach a crisis in a similar fashion. Problems for which knowledge is hardly available and uncertain, with society disaccording with the values attached to the crisis, are referred to as *wicked problems*. Such problems require specific mechanisms that can drive the authorities' decision-making and action-taking processes to a more adequate emergency response. Following prominent theories in the field of crisis management we assume that *politicization*, *geopolitical implications*, *improvisation from protocols* and *interagency collaboration* are the core mechanisms that underlie the crisis management in a crisis such as the Fukushima nuclear accident. The reader will be provided with conceptualizations and hypothesize about possible relations between the variables in the following section.

Strikingly, different theories use different definitions to conceptualize *adequacy of crisis management*. The Dutch Inspectorate of Security and Justice specifies six dimensions as key elements, which need to be successfully organized (Inspectie voor Veiligheid en Justitie, 2012): (1) preparation, (2) recognition and signaling of crisis, (3) provision of information within crisis organization, (4) analysis, judgement, and preparation of decision-making, (5) decision-making and steering, and (6) crisis communication. Only if all these elements are truly satisfactorily performed, crisis management is successful. Boin et al. (2005) offer a similar approach, albeit using a different terminology to explain the stages of crisis management. They presume that sense-making, decision-making, meaning-making, terminating, and learning from a crisis mark a typical emergency response.

The present study partially builds upon the Inspectorate's conceptualization - while taking into account that this conceptualization, just like the one from Boin et al. (2005), originates from a ‚Western view'. In order to incorporate the specific cultural background of the study context (Japan) it would be more reasonable to take an Asian conceptualization of the variable *adequacy of crisis management*. Yet, as explained above, no such conceptualization exists. As we deem the cultural background of the country where a crisis occurs to be very important, Hofstede's (2010) work will facilitate a categorization of Japan's cultural values and, hence, ensure an appropriate, theory-based evaluation[1].

[1] More on that is to be found in Chapter 4.1.

2.2 Hypothesis 1: The Effect of the Level of Politicization

One important theory for the explanation of crisis management emphasizes the temptation of decision-makers to hide the crisis from the world (Rosenthal et al. 2001). However, the main hypothesis underlying this study builds upon the assumption that in highly transnationalized and internationalized crises it will not be possible to hide the crisis from the world - especially if politicization and mediatization within and beyond the boundaries of the affected country spotlight every single step decision-makers take (ibid.). On the basis of the work of Koppenjan et al. (2004), politicization is understood as the process of framing problems and possible solutions. If a government defines a problem and clearly identifies its roots and causes, disagreement among the public might be reduced or even eliminated (Weick et al. 2005). However, attention spread by the media – the so-called mediatization of a problem or a crisis - forces decision-makers to respond to a disaster in such a way that negative consequences for the population and environment are kept at a relatively low level. Therefore, the media play a crucial role in the conduct and adjustment of crisis management (Utz et al. 2013). The media have the power to initiate blame games, which serve as a possibility for the public to make their elected leaders and politicians accountable for the specific actions and decisions they have taken (Hood 2002). Here, the salience approach applies (Mitchell et al. 1997). The more important an issue is, the more prominent it becomes and the more people are tracking every little step of crisis management.

In the case of Japan, it is important to examine whether authorities framed the crisis as a nuclear accident or as an unfortunate consequence of unexpected nuclear disasters. According to the typology of problems by Koppenjan et al. (2004), the Fukushima nuclear accident could be defined as a wicked problem, since both a high level of knowledge/information uncertainty, and a high level of societal disagreement about the nature of the crisis were prevailed. In addition to the mediatization, the societal disagreement sets the respective decision-makers under pressure and, as long as the pressure remains at a level which still positively promotes crisis management, authorities try to achieve the best possible solution.

Consequently, it is assumed that a higher level of politicization as a means of the public to hold decision-makers accountable for their decisions and actions leads to an enhancement of adequate crisis management and is able to drive the relations of the other variables in the present causal diagram.

Hypothesis 1. A higher level of politicization results in a more adequate crisis management if the crisis itself is appropriately signaled and communicated (Effect (a) in the causal diagram).

2.3 Hypothesis 2: The Effect of the Geopolitical Context

As described above, politicization is assumed to be a prerequisite for adequate and successful crisis management. The conditional nature of politicization becomes prominent especially regarding the geo-

political context. Nuclear energy disasters may affect neighboring countries in the short-term by radioactive release (Ten Hoeve et al. 2012). In order to allow for an adequate risk assessment on the part of neighboring countries, first, the recognition and signaling of the crisis and, second, crisis communication are crucial (Lagadec 2007). Middle- and long-term implications are, for instance, the consideration of a nuclear phase-out or the (re-)assessment of the safety of the respective nuclear power plants (Boin et al. 2005; Kim et al. 2013). This does not merely apply to direct neighbors but to countries all over the world. Hence, politicization can trigger new dynamics in the discussion about nuclear power all over the world, wherefore the relation between the adequacy of crisis management, the geo-political context and politicization has to be understood as a cyclic relation.

If the country in which the crisis originates does not satisfy the dimensions *recognition and signaling of a crisis*, and *crisis communication*, foreign countries lack the knowledge of the crisis, albeit being affected either in the short- or middle- and long-term. This hinders them to influence the crisis management process (via politicization) which in turn would deteriorate crisis management. Hence, the relationship between *politicization*, *adequacy of crisis management* and the *geo-political implications* present themselves as mutually dependent variables, predominantly the two dimensions mentioned above ((2) and (6)), must be satisfied in any case.

Hypothesis 2. The consequences of geo-political implications stimulate politicization if certain preconditions of crisis management are satisfied. (Effect (b) in the causal diagram).

2.4 Hypothesis 3: The Effect of Improvisation from Protocols

Furthermore, when it comes to *recognition and signaling of a crisis*, and *crisis communication*, the adherence to protocols is indispensable in order to guarantee adequate communication to the abroad (Perko 2011). These effects were already discussed in the context of Hypothesis 2. It is also important to stick to protocols for the preparation and provision of information within the crisis organization in order to ensure full informedness and preparedness of all relevant bodies. Moreover, adherence to protocols might facilitate quick and adequate emergency response when it comes to the responsibilities of different bodies (Christensen et al. 2015). Giving an example, it has to be elaborate which body is responsible for the provision of medical care, food and drinking water, or as in the case of Fukushima, the organization of housing for evacuees. Such responsibilities must be applicable to every single crisis (Bigley et al. 2001[2]).

By contrast, improvisation will be needed when it comes to the *analysis, judgment, and preparation of decision-making*, and the *decision-making and steering* itself, since every crisis has a unique character on which actions need to be adapted flexibly. Thus, improvisation can affect the adequacy of crisis management either in a positive or in a negative way depending on its particular dimensions. It varies between „organizational stability preparedness“ and „flexibility and rapid response“ (ibid. p. 1).

[2] About the Incident Command System established in the United States after hurricane Katrina.

Hypothesis 3. Improvisation from protocols can have a positive effect on dimensions (4) "analysis, judgment, and preparation of decision-making", and (5) "decision-making and steering" of adequacy of crisis management, whereas it is assumed to negatively affect dimensions (1) "preparation", (2) "recognition and signaling of crisis", (3) "provision of information within crisis organization", and (6) "crisis communication" (Effect (c) in the causal diagram).

2.5 Hypothesis 4: The Effect of the Level of Interagency Collaboration

A fourth important variable that can be derived from literature is the *level of interagency collaboration*. House et al. (2014), trying to conceptualize the term, conclude that the complexity of crises and the corresponding diversity of interests and demands „transcend the capabilities of any one individual" (House et al. 2014, p. 329) from which derives „the need for interoperability and collaborative decision-making" (ibid. p. 330) with the assistance of the international community. This is an important factor of interagency collaboration. Yet, Bardach (2015) points at the need of some centralized coordination which makes collaboration possible. He calls this a „collaborarchy" (Bardach 2015, p. 2), establishing a mixture of collaboration and hierarchy where it is needed. He sees hierarchy rather in the light of structure, whereas collaboration determines the process of crisis management. At this stage of research, the Japanese crisis management system seems to apply to such a collaborarchy. Provan and Kenis (2008) elaborate this further in stating that „[a]lthough individual organizational participants may, and probably should benefit as well, effectiveness is viewed here at the network level" (Provan & Kenis 2008, p. 230). They assume that individual organizations and participants cannot reach as positive outcomes as networks. Following this conceptualization, one can hypothesize that a higher level of interagency collaboration, or collaborarchy, enhances the adequacy of crisis management.

Hypothesis 4. A higher level of interagency collaboration positively affects the adequacy of crisis management (Effect (d) in the causal diagram).

2.6 Hypothesis 5: The Effect of Culture

The present study departs from the overall assumption that the cultural background of a specific country strongly affects crisis management (e.g. Pearson & Clair 1998, Hofstede et al. 2010). As explained in the introductory part, mainly the Western perceptions of crisis management have been subject to this research field. However, the cultural background is presumed to be a framework in which all other variables related to crisis management are embedded. Culture brings about a certain understanding of politics which in turn conditions organizational processes (Pearson & Clair 1998). This, however, might provoke difficulties in the process of crisis management if a country has to deal with an internationalized crisis ('t Hart 2013). The international community might impose widely accepted standards on a country like Japan, and an emergency protocol is being compiled based on these very standards. Yet, in times

of a crisis, it might turn out that these standards are not suitable for the respective country, i.e. Japan, which is driven by a completely different cultural background than, for instance, the USA. The outcome: crisis management fails.

This is only one possible way how culture might affect crisis management. In order to understand what culture means and how it conditions the professional realm, Hofstede's cultural index (2010) will serve as a means to categorize Japan. This shall help to properly evaluate the adequacy of crisis management of the Fukushima nuclear accident in 2011 and the connected variables presented above.

Hypothesis 5. Culture conditions crisis management.

Including all relevant variables (in the case of politicization we speak of a process) and hypothesized relations, the final causal diagram looks as follows:

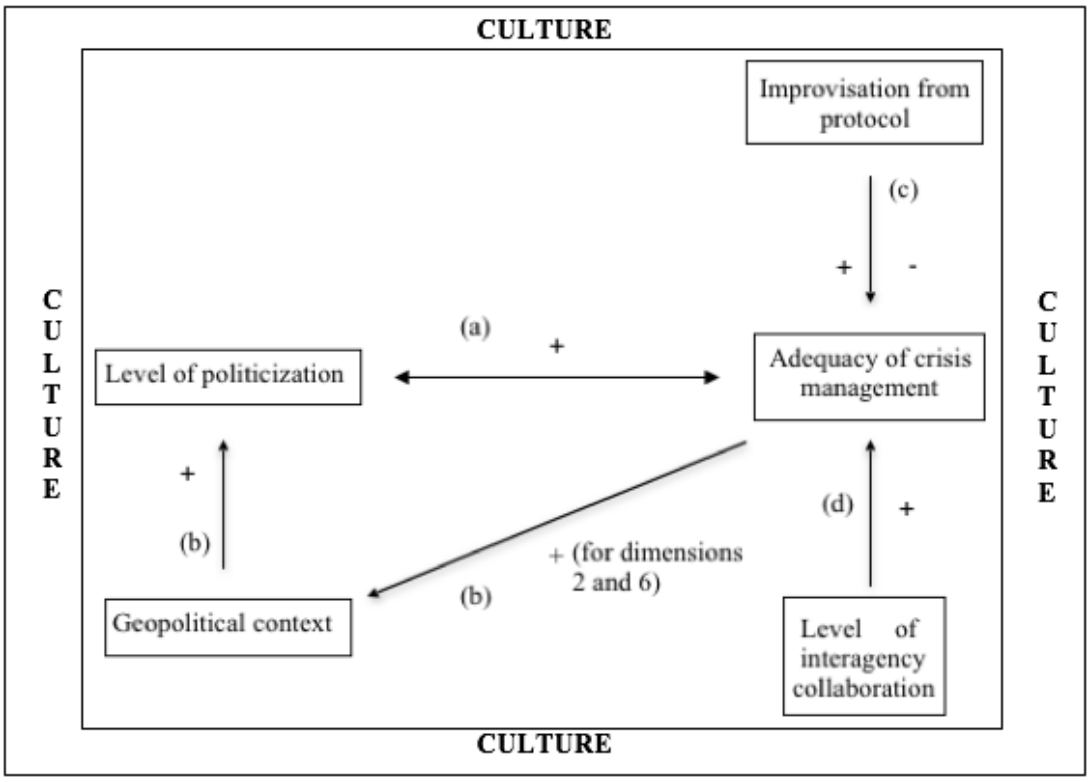

Figure 1: Causal diagram

3 Methodology

3.1 Research Design

The analysis of the research question guiding the single case study of Fukushima departs from an approach, described by Blatter and Haverland (2012) as *causal-process tracing*. This approach to case study research is different from research designs in a classical sense, such as longitudinal comparisons

or cross-sectional designs. Adherents of causal-process tracing assume that „multiple causal conditions work together at a specific point of time or over a short period of time to produce the outcome of interest" (ibid. p. 94). This could be referred to as a „comprehensive storyline" (ibid. p. 111) highlighting theoretically informed storytelling in which first a timeline of critical events is built before reconstructing major processes occurring jointly and showing how they developed over (different periods of) time. The purpose of this approach is to detect a causal chain of action and reaction patterns that drive the relation between variables and processes. This reveals critical events and mechanisms as well as different actors' perspectives, their activities and the interaction between them.

This approach perfectly serves the purpose of the present research as it not only focuses on the outcome, but also includes „smoking guns" and „confessions" (ibid. p. 119) into the process tracing. This means that outstanding observations in conjunction with perceptions and motivations of the stakeholders would have a significant impact on the actual outcome. Yet, the quality and trustworthiness of these confessions have to be assessed critically as they are personal characteristics of subjects and may bear the threat of blurring objective observations. To counter this threat it is necessary to always examine statements (or facts) from different sources and to connect the „smoking guns" with theories. This contributes to the validity and relevance of the study. It has to be taken into account that such a specified single case study hardly allows for „drawing conclusions beyond the case under investigation" (ibid. p. 104). However, Japan as a deviant case bears the chance of opening a new research area which would be a great contribution to crisis management research.

Causal-process tracing presents a useful way of understanding theory-based mechanisms responsible for an outcome. A research design that complements the approach is *Realistic Evaluation* invented by Pawson and Tilley (1997). Realistic Evaluation enables the researcher to observe (the combination of) specific mechanisms in a distinct context causing the outcome of an event which is, in this study, defined by the case of the meltdown of the Fukushima nuclear reactor. Derived from this, the research will be based on a generative model in which „the mechanism is responsible for the relationship itself" (Pawson & Tilley 1997: p. 68) which highly „depends on it being in the right conditions [/context]" (ibid. p. 69). This research design fits the proposed study since it examines the exact same things: the extent to which different mechanisms - the independent variables - influenced the adequacy of crisis management and to address the question under which conditions certain mechanism do not work. By this, this study refers to all three features of Realistic Evaluation: context, mechanisms and outcome. Originally, Pawson and Tilley (1997) presumed a comparative approach in which different contexts are compared aiming at observing the different outcomes. This is possible in the case study of Fukushima albeit being aware that this would raise the explanatory relevance. However, the aim of the study is not the generalization of the findings but rather the explanation of a deviant case in the context of crisis management.

3.2 Case Selection and Sampling

The case of the meltdown of the nuclear reactor in Fukushima in the context of a study into the adequacy of crisis management, and the mechanisms underlying this process, has been selected primarily by its feature of being potentially deviant to what scholars in crisis management have focused on thus far. Japan has a different political make-up and shares different values than Western societies which are usually covered by theories and concepts of crisis management. It is assumed that this particular case reveals useful knowledge from a new and interesting (cultural and political) angle. The core question why Japan provides a highly interesting context for the study of adequate crisis management is: „How could the system completely break down, while being very hierarchically organized, which is actually good for crisis management?" Hence, the aim of the study is not to simply criticize and outline what went wrong in Fukushima but rather to identify the mechanisms at work. The reason for choosing one single case is that this allows for deeper insights in the very mechanisms mentioned earlier. In this manner, it becomes possible „to invest heavily in the search for many pieces of empirical evidence" (Blatter & Haverland 2012: p. 110) instead of focusing on a vague picture of crisis management.
A second important criterion has been the convenience in terms of accessibility to and availability of empirical information which is crucial for the attempt „to understand the perceptions and motivations of the actors" (ibid. p. 106) and to infer the behavior of stakeholders from what is reported.

3.3 Operationalization and Data Collection

To study the mechanisms that drive the relation between the independent variables *level of politicization*, *geopolitical context*, *improvisation from protocols*, *level of interagency collaboration* and *cultural background*, and the dependent variable *adequacy of crisis management*, exclusively qualitative data will be used. Additionally, the present study will test whether theory provides enough explanatory power to understand the mechanisms driving the crisis management of Fukushima. According to Pawson and Tilley (1997), this allows for reconstructing the processes at work on the basis of available sources in order to understand the different, and sometimes complex causal relations between the different variables.

3.3.1 Adequacy of Crisis Management

The six dimensions of adequacy of crisis management (Inspectie voor Veiligheid en Justitie, 2012) can only be evaluated properly, if tracing back their success or failure to mechanisms in the shape of the variables analyzed in the present study renders possible. It is presumed that the data used for the research – evaluative reports from official authorities, newspaper articles, official statements from governments and relevant bodies, press conferences and secondary literature - appropriately serve the purpose of this

study since they create a broad picture of both reality and ideal of Japanese crisis management. This combination allows for inferring the findings related to the variables resulting from the complete dataset to the six components of adequacy of crisis management. Finally, this enables a fact-based and logic evaluation of the dependent variable and a comprehensive answer to the research question.

3.3.2 Level of Politicization

As described above, politicization is measured in terms of the national and international media coverage, referred to as mediatization, and the level of disagreement among society. Strikingly, there is no common agreement about what politicization is and how it works, which is why this study builds upon the conceptualization outlined above. Here, the salience approach (‚the more important it is, the more prominent it becomes') illustrates how this research will evaluate the level of politicization. Because of language barriers, it is not possible to simply analyze how often and to which extent articles were published in Japan's national and local newspapers at that time. However, some Anglophone media are available which serve as the main source for the measurement of politicization. This allows for discovering indications on the media that may point at different definitions of the problem and solutions, which is indispensable for the evaluation of the different components of adequacy of crisis management. Additionally, the analysis of press conferences and statements of the most important decision-makers during the Fukushima crisis is expected to reveal patterns of a blame game. Yet, it has to be highlighted that the purpose of this study is not a full-fledged media analysis but the attempt to get a comprehensive overview of the whole crisis management. Data triangulation for each variable will allow for the confirmation of data which enhances their reliability and external validity.

3.3.3 Geopolitical Context

The level of politicization is tightly connected to the geopolitical context. Subsequently, the variable is to be analyzed on the basis of official statements from foreign governments and media coverage abroad to capture their respective risk assessment evolving from possible nuclear radiation. This reflects the short-term implications of the geopolitical context. If coverage is high and the statements are numerous and pressure-inducing, the geopolitical context is assumed to indeed lead to a more adequate crisis management. Middle- and long-term implications for non-neighboring countries as explained above will be examined by the exact same data (official statements and reports of governments and decisive bodies and newspaper articles). Secondary literature shall, on the one hand, offer valuable clues to the achievements of Japan's crisis signaling and communication to the abroad, and, on the other hand, to possible changes in nuclear energy policy worldwide resulting from Japanese crisis management.

3.3.4 Improvisation from Protocols

The most important data for the analysis of *improvisation from protocols* are three official reports that all evaluate the crisis management from different angles and give clues about how it *should* have looked like and how it was *actually* performed. These reports comprise, firstly, a report of the Japanese government to the International Atomic Energy Agency (Government of Japan 2011), secondly, a report from the Director General of the IAEA (International Atomic Energy Agency 2015), and thirdly, a report of the Fukushima Nuclear Accident Independent Investigation Commission of the national diet of Japan (hereinafter *Independent Investigation Commission*) (The National Diet of Japan 2012). Having tried to obtain the complete emergency protocol from the Japanese government, it rendered impossible to retrieve this information, as the responsible agency declared that the emergency protocol would no longer exist. Hence, data triangulation ought to prevent subjective evaluations and possible information distortion. This ensures a reliable and valid use of data with which conclusions can be drawn on whether the crisis management during the Fukushima nuclear accident was adequate.

3.3.5 Level of Interagency Collaboration

The analysis of legal texts (e.g. the Act on Special Measures Concerning Nuclear Emergency Preparedeness) will create an overview of how interagency collaboration was intended to be, and which responsibilities should have been assigned to which stakeholders. In a next step, this will be compared with an organization chart compiled by the analysis of the three official reports mentioned in section 3.3.4, and of secondary literature that elucidate the failures in interagency collaboration. The study will then evaluate crisis management on the basis of the resulting findings in the context of the variable *level of interagency collaboration*.

3.3.6 Cultural Background

The information on the categorization of Japan's cultural background driving the working mentality and, therefore, also the decision-making and action-taking processes during crises, is fully retrieved from Hofstede's cultural index (2010). This allows for a classification and comparison in international respects and a comprehensive subsumption of the other variables in the cultural framework.

3.4 Data Analysis

The observations derived from the case description and data analysis will be used for an attempt to draw causal inferences on the mechanisms that drive adequacy of crisis management. Possible interaction effects of the independent and the dependent variable will be studied in order to provide a deeper

understanding of the mechanisms that drove the crisis management in Japan in 2011. These mechanisms are observed in a specific cultural context which then conjunctively lead to the outcome. This is the process from which conclusions will be derived. Additionally, the study points at a case which deviates from previous findings in terms of the overall make-up. Japan is hierarchically governed and promotes other values than Western governments and societies do. The aim is not necessarily to be able to generalize the findings to a universe of (future and past) crises, but rather to improve one's understanding of how crisis management in a particular country, i.e. Japan, is successfully organized, which aspects threaten a successful crisis management, and how decision-makers could (have) deal(t) with these. Because this case study requires the analysis of qualitative data, causal inference presents the most appropriate way to arrive at a systematic story.

4 Case Description

4.1 The Cultural Dimension

The cultural dimension of the case Japan is an important factor for the research of the structure and the realization of crisis management. It is likely that a certain cultural background influences the decision-making process, the structure of the crisis management network as well as the different actions of crisis management itself (Pearson & Clair 1998). In order to be able to interpret the case in terms of culture, Japan will be categorized by means of the cultural dimensions theory developed by Geert Hofstede (2010). Hofstede determines culture as "the collective mental programming of the human mind which distinguishes one group of people from another" (Hofstede et al. 2010). He tries to explain how values in the workplace are influenced by culture. This reveals the main benefit of using his theory for the analysis of Japan, namely to understand why and how certain decisions and actions were taken and why processes did not work out as intended.

The 6-D Model consists of six dimensions: the power distance index, individualism versus collectivism, masculinity versus femininity, uncertainty avoidance index, long term orientation versus short term normative orientation, and finally indulgence versus restraint. Countries can be categorized on a scale from 0 to 100 with 50 as a midpoint. If a country's score is above 50, it is considered to score high, if it is below 50, a country scores low. In the following, the dimensions will be applied to Japan referring to Figure 2.

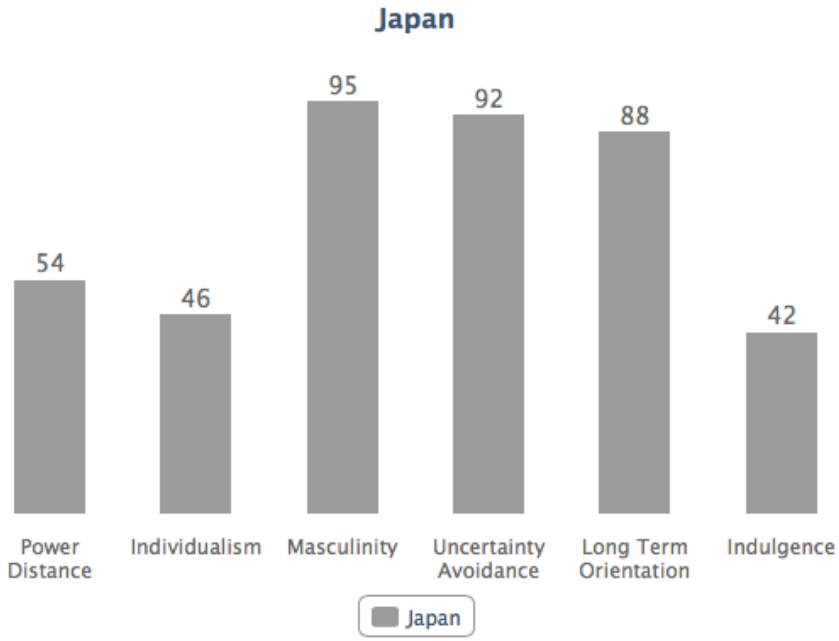

Figure 2: Hofstede's cultural dimensions index for Japan (Hofstede, n.d.)

The power distance index evaluates a country's inequality in terms of power distribution. It addresses the question to what extent the less powerful members of a society accept and support this inequality. With a score of 54 Japan is a "borderline hierarchical society" (ibid.), meaning that albeit a hierarchical structure and its acceptance is prevalent, Japan is less hierarchical than other Asian countries such as China, India or Russia (cf. Figure 3). On the one hand, the strict adherence to hierarchy considerably slows down decision-making processes as each hierarchical layer is approached to give accordance. This aspect is significant for the analysis of crisis management as the strong adherence to hierarchy might negatively affect governance emergency. On the other hand, Japanese culture assumes equal chances for everybody if one works hard enough.

On the dimension individualism versus collectivism, Japan is individualist with a score of 46. As the term indicates, people only take care of themselves and their close families in an individualist society and are part of loose societal groups. Subsequently, they are not characterized by unconditional loyalty and interdependence of one another as in a collectivist culture. The main struggle is whether members of a culture see themselves as *I* or *We*. Although Japan features some collectivist characteristics such as the perpetual pursuit of harmony and the importance of good reputation, it is not as collectivist as other Asian countries. This might be the result of a less extended family system making Japan a paternalistic society. Hofstede (2010) describes the Japanese as "more private and more reserved than most other Asians" (ibid.) excluding China or Russia (cf. Figure 3). The consequences of an individualist behavior in crisis management might be a missing will for taking responsibility and limited accountability. It might turn out due to this cultural feature that for due the society's well-being was subordinate to individual interests during the Fukushima crisis.

Japan is one of the most masculine cultures worldwide as the score of 95 on the dimension masculinity versus femininity indicates. Compared to the United States, Germany, China, India and Russia which score more or less equal on this dimension, Japan exceeds their values outstandingly (cf. Figure 3). A masculine society is highly competitive so as to being successful is the most important achievement. Whereas in feminine cultures *liking what you do* and the quality of life are the main motivations that drive society. In Japan the sense for competition is omnipresent which makes society strive for perfection and excellence in all respects. Although these values are not negative per se, the distinct sense for competition might hinder effective interagency collaboration during a crisis.

The fourth dimension uncertainty avoidance is unambiguous: it determines the degree to which a society values the avoidance of unknown situations and practices better than striking new paths. Such cultures try to predict every possible risk and to establish appropriate measures to be prepared for such situations. As Japan is constantly exposed to threats by natural disasters, it is comprehensible that the country scores 92 on this dimension. At this score it is one of the most uncertainty avoiding countries in the world next to Russia which scores almost equally (cf. Figure 3). This is not only visible in risk management, as Hofstede (2010) presumes, but also in daily life which is highly ritualized. It can be assumed that such a high level of uncertainty avoidance paves the way for meticulous planning of emergency response which would positively affect the adequacy of crisis management.

The dimension long term orientation versus short term normative orientation measures how a culture proceeds to maintain links to its past while simultaneously approaching future challenges. Short term oriented societies score low on the dimension since they usually object to societal changes and better stick to traditions. Those societies are merely oriented towards the past. In contrast, cultures with a long term orientation such as Japan scoring 88 on this dimension, prefer the orientation towards remote future. Everything is built, founded and decided with the purpose of long durability. This is no curiosity in the international context where rather low scores are out of ordinary (cf. Figure 3). Long term orientation is presumed to be advantageous for crisis management leading to the assumption that careful preparation is in place.

Finally, the dimension indulgence versus restraint describes whether or not a society allows and accepts the gratification of needs and pleasures. With a score of 42, Japan is a culture of restraint which is in line with the overall assumption of a Japanese workaholic lifestyle. Success at work is more important than leisure time and the gratification of desires. This is a norm children and young people get early socialized with. Many societies worldwide show similar scores (cf. Figure 3) which could be beneficial in times of a crisis where rational thinking and the ability to work under pressure are indispensable.

The categorization on the six dimensions will serve as a basis for the analysis and evaluation of the crisis management during the Fukushima nuclear accident in 2011. At this point, it is not yet declared impossible that one or more of the dimensions will be proved wrong or simply inadequate for the evaluation of all spheres of cultural life in Japan.

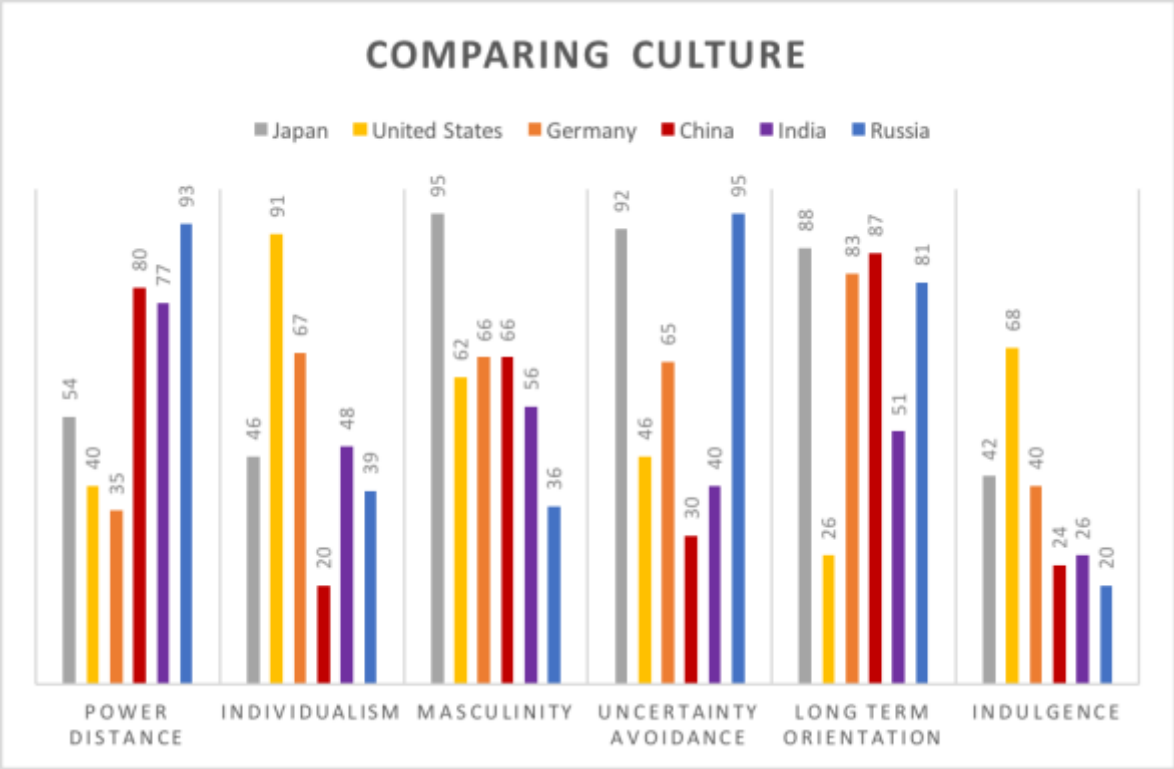

Figure 3: Hofstede's cultural index for Japan compared to other countries (Hofstede, n.d.)

4.2 Chronology of the Crisis

4.2.1 General Information About Fukushima Daiichi Nuclear Power Plant

The Fukushima Daiichi nuclear power plant was constructed in 1967 and commenced production in 1971. It is located in Okuma Town and Futaba Town, Futaba County, Fukushima Prefecture in Japan, facing the Pacific Ocean on the east side. This research analyzes solely the developments and the crisis management for the Fukushima Daiichi nuclear power plant. However, it is necessary to mention that the vicinal Fukushima Daini nuclear power plant was equally exposed to the earthquake and tsunami on 11 March, 2011 and posed a severe threat for a short time (cf. Figure 4). Yet, the situation stabilized quickly while Fukushima Daiichi remained a real threat for weeks and still poses danger to the environment and the people.

The facility is operated by the Tokyo Electric Power Company, Incorporated (TEPCO) and assembles six nuclear reactors as visualized in Figure 5. Fukushima Daiichi NPS uses boiling water reactors in which steam is produced in order to drive energy-producing engines. The steam is led back to the

reactors in the shape of cooled water in order to cool down the reactor. Within the vessel, fuel rods are surrounded by water in which radioactive isotopes circulate. Normally, this cycle is closed to avoid the release of radioactive material. Appendix C provides more detailed information on how a nuclear reactor works.

Figure 4: Locations of Nuclear Power Stations in Japan (Government of Japan 2011)

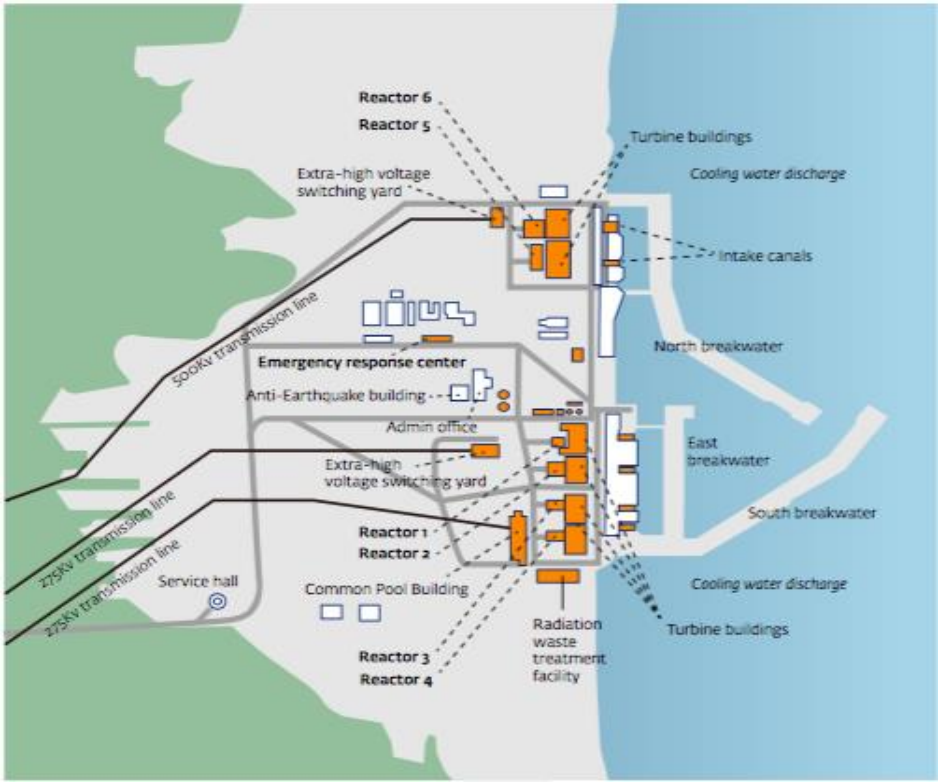

Figure 5: Fukushima Daiichi nuclear power plant site (Whitty 2012)

4.2.2 Timeline of the Accident[3]

4.2.2.1 Overall Outline of the Accident from March 11, 2011 till May 31, 2011[4]

On March 11, 2011 at 14:46 an undersea earthquake with the magnitude 9.0 hit Japan off the Pacific coast of Tohoku. This quake triggered a tsunami moving fast towards the northeast of Japan – a region in which several nuclear power plants such as the Fukushima Daiichi NPS are located. Albeit all NPS were affected by at least a loss of electricity, Fukushima Daiichi NPS suffered the most. After the earthquake, the first safety system was activated initiating the complete insertion of the control rods leading to an automatic shutdown of all reactors. At first, everything developed as planned until the automatic shutdown became revoked. In such a case the second safety system takes effect: the activation of diesel generators. Due to the tsunami and the vulnerable location of the generators in the containments' basements, however, most of the generators were flooded so that the plant lost the ability to maintain the indispensable cooling and water circulation functions. A third and last safety system which activates the spraying of water into the reactors for cooling reasons also failed. This made the Fukushima Daiichi NPS highly vulnerable to any kind of incidents and accidents. As a result of the loss of all cooling functions at Units 1, 2 and 3, the International Nuclear and Radiological Event Scale (INES) was determined as a Level 5 accident, while the events at Unit 4 fell in the category of a Level 3 incident. As explained earlier, the Fukushima Daini NPS posed a threat for a short time but could shift all reactors to a cold shut down condition relatively soon. It was determined as a Level 3 nuclear incident on the INES scale.

***Information Box 2**: International Nuclear and Radiological Event Scale*

The International Nuclear and Radiological Event Scale (INES) is a tool to promptly evaluate the severity of nuclear and radiological events in order to facilitate consistent communication. Such events might occur during the transport, storage and use of radioactive material and radiation sources (https://www.iaea.org/sites/default/files/ines.pdf 2016).

[3] The information about the developments of the plant and their consequences is consistent among and thus derives from the International Atomic Energy Agency (2015), the Government of Japan (2011), and the National Diet of Japan (2012).

[4] Although the reconstruction measures in the aftermath of a crisis are an important factor of crisis management, the focus of this research is exclusively on the immediate response to the nuclear accident at Fukushima Daiichi. Hence, as most of the updates destined for foreign countries and the foreign press stop at May 31, this day serves as the end date of the examined period in this research. It indicates that the crisis level has gone down while simultaneously reflecting the administrative activity during the first twelve weeks after the accident.

Three dimensions are being considered for the classification: people and environment, radiological barriers and control, and defense-in-depth. The category "people and environment" covers the release of radioactive material and the resulting radiation dose people and environment close to the event are exposed to. "Radiological barriers and control" comprises radiation doses and the release of radioactive material that do not have any direct effect on people or environment as they do not leave the facility. The category "defense-in-depth" covers the same issues as the second category by implying that certain countermeasures did not turn out to be as effective as planned. The scale ranges from 1 to 7 in which 7 represents an event with the highest possible severity. Levels 1 to 3 are classified as "incidents", levels 4 to 7 "accidents" as visualized in Figure 6. Table 1 (Appendix C) provides for the definition of each of the seven levels.

Figure 6: INES Scale classifications (Source: http://www-ns.iaea.org/tech-areas/emergency/ines.asp)

4.2.2.2 Technical Development of the Six Nuclear Reactors at Fukushima Daiichi NPS

In the following the developments of the six nuclear reactors will be briefly outlined in order to disclose in what way the different Units contributed to the worsening of the situation[5].

a) Units 1 to 4[6]

In Chapter 4.2.2.1, the three safety systems ought to guarantee an uncritical functioning of a nuclear power plant even under the circumstance of natural disasters or other events affecting the facility have been explained. It was also presented that and why all safety systems failed. As a consequence, all reactors except for Unit 6 lost their cooling functions which was the reason for a constant increase in pressure inside the reactors increased constantly. TEPCO proposed to vent the containments which had

[5] Summaries of the developments of all six units at two different points in time are provided in Appendix C.
[6] The condition of Unit 4 differed from Units 1, 2 and 3 as it was shut down for routine maintenance before the earthquake. For the inspection work of the core all fuel rods had been moved from the reactor to the spent fuel pool which took almost all of its storage capacity. The spent fuel pool was filled with water to cool the fuel.

to be prepared carefully in order to prevent the release of radioactive material posing a severe threat to the atmosphere. In case this happens, radioactive material is likely to come down to the earth as rain which bears the risk of contaminating the soil and the surface seawater.

Right after the loss of power, measurements of temperatures, water levels and water injection was no longer possible which made the situation unclear and dangerous. TEPCO estimated that the fuel in the reactor cores was uncovered (in some reactor only partially) for several hours after the earthquake with severe damaging impact on the reactor due to partly core melting processes. Thereby, radioactive materials were released from the fuel into the reactor pressure vessel so that the radiation dosage kept rising within the containment. These developments, first and foremost the continuously rising pressure, provoked hydrogen explosions at Units 1, 2, 3 and 4 between March 12 and March 15 which primarily damaged the outer shells of the containments. Units 2 and 4 suffered damages at their primary containment vessels. After the explosions, smoke kept rising from the buildings which explains the measurement of radioactivity outside the containments. Despite the new events, workers began to inject a mixture of seawater and boron into the primary containment vessels to ensure full coverage of the fuel rods with coolant. This measure was repeated multiple times as of March 12. On March 15, officials estimated core damages for Unit 1 at 70%, for Unit 2 at 30% and for Unit 3 at 25%. These estimations were adjusted on May 2 (Unit 1: 55%; Unit 2: 35%; Unit 3: 30%). The spent fuel pool of Unit 4 developed to be the major safety concern because of missing information about the water level and temperature until April 28 when the first measurements were made possible by electricity restorations.

As of March 17, Units 1, 2 and 3 were relatively stable since no severe aggravations could be reported. On March 20, external power supply could be restored. From that day onwards, the power supply network was constantly growing. However, it was still not possible to obtain information about the water level and the temperature in the spent fuel pools which made them to be of great concern.

On April 2, workers detected that highly contaminated water leaked from Unit 2 into the sea which seriously affected the ocean's ecosystem. The outflow was stopped on April 6.

On April 11, an aftershock of the Great East Japan earthquake caused the cut from external power supply, the consequential shutdown of the reactor injection pumps and the interruption of nitrogen injections. All processes were resumed after a couple of hours.

On April 14, workers installed silt fences to prevent the diffusion of contaminated water; other counter-tsunami measures followed just like numerous monitoring activities inside and outside the plant.

The technical updates on the status of the reactors stopped on May 16, 2011.

b) Units 5 & 6[7]

Since January 3, 2011 Unit 5 was in a shutdown condition due to periodic inspection work. All fuel rods were arranged in the reactor core. Just before the earthquake on March 11, a pressure leak test for the

[7] Unit 6 was of least concern during the whole accident. Since August 14, 2010 the reactor had been shut down due to periodic inspection and was put into a cold shutdown condition before the earthquake. The reactor core was loaded with all fuel assemblies in advance to the quake.

reactor pressure vessel was being conducted. Because the tsunami flooded and deactivated the two diesel generators, the equipment applying pressure on the reactor pumps halted, so that pressure increased at first and experienced seesaw changes afterwards. Workers conducted pressure reduction operations on March 12 and made big efforts on March 13, when a condensate transfer pump could successfully inject water into the reactor. This was made possible by the transfer of power from a diesel generator of Unit 6 as the only operable one remaining after the flooding[8]. Hence, Unit 6 was the only reactor that did not completely loose power. Through the transfer of power from Unit 6, the reactor pressure and water level at Unit 5 could be controlled. The condition of the spent fuel pools was of concern as the water levels were constantly declining causing temperature increases until March 19, when workers could achieve the installation of a temporary seawater pump activating a residual heat removal system. Moreover, they opened three holes in the roofs of the reactor buildings of Units 5 and 6 in order to prevent the accumulation of hydrogen. Because the cooling of the spent fuel pools and the reactor cores could be restored on March 20, Units 5 and 6 were brought to a cold shutdown condition[9]. On April 5, low-level radioactive groundwater was discharged from Unit 6 to the sea. The technical updates on the status of the reactors stopped on May 12, 2011.

4.3 Crisis Management

4.3.1 Japanese Authorities Responsible for Nuclear Crisis Management

In the previous paragraphs the timeline of the Fukushima nuclear accident was described. Some actors that were involved in the crisis management process have already been mentioned. Figure 7 provides a comprehensive organization chart of the crisis management network as it was compiled on the basis of the analysis of several policy papers, newspaper articles and significant studies of the Fukushima crisis[10].

[8] This emergency diesel generator was installed at a relatively high position in contrast to all other diesel generators of Units 1 to 5.
[9] A cold shutdown can be established as a safe mode only if all cooling systems and the respective low temperatures as well as the pressure are stable within the reactor.
[10] The exact sources are listed in Appendix A.

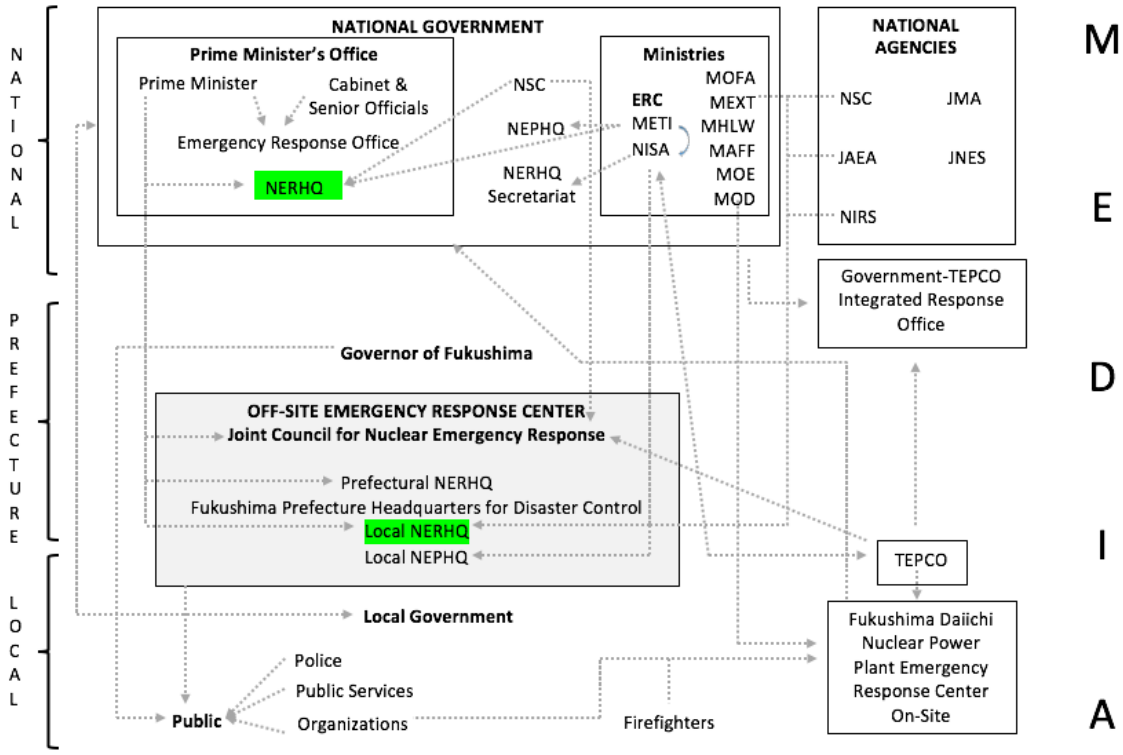

Figure 6: Organization chart of the crisis management of Fukushima nuclear accident

In Japan, the management of a nuclear crisis was intended to be separated vertically into national, prefectural and local responsibilities with the purpose to spread the tasks according to available resources and the respective target groups to reach an emergency response at its best. It was assumed, for instance, local authorities should decide on evacuation processes as they are nearest to the affected local residents. Yet, due to different mechanisms that will be pointed out in Chapter 5, responsibilities were shifted to higher levels during the emergency response.

Only some hours after the tsunami, the Deputy Chief Cabinet Secretary for Crisis Management Yukio Edano established the Government Emergency Response Office within the Prime Minister's Office staffed with cabinet deputies and senior officials. The former Prime Minister Naoto Kan was the entity where many threads converged and from which many departed. He established the National Nuclear Emergency Response Headquarters (NERHQ) and was appointed to Director General of this body. The NERHQ worked closely together with the local and the prefectural NERHQs having been situated at the off-site emergency response center near the Fukushima Daiichi NPS. The national and the local NERHQs ought to serve as the core entities of crisis management issuing directions and coordinating the national response at the different levels. Besides these two NERHQs, the Emergency Response Center (ERC) of the Ministry for Economy, Trade and Industry (METI) and the Nuclear and Industrial Safety Agency (NISA) played a crucial role right after the tsunami hit the NPS. METI established the national and local Nuclear Emergency Preparedness Headquarters (NEPHQ) and supplied staff for the NERHQ Secretariat which was to support the national NERHQ. Moreover, NISA issued regulatory directions to the nuclear power plant's licensee TEPCO and in turn was informed about new

developments and protective measures at the plant. Other ministries and national agencies such as the Ministry of Defense (MOD), the Ministry for Education, Culture, Sports, Sciences and Technology (MEXT) or the National Safety Commission (NSC) provided professional assistance and advice in technical, medical, radiological, administrative and monitoring matters either to the Government, the off-site ERC or to the Power Plant[11]. At Fukushima Daiichi NPS an on-site ERC was established by TEPCO right after the earthquake in order to facilitate measurements, monitoring, the evaluation of new developments and their signaling to authorities. On March 15, the Government-TEPCO Integrated Response Office was established for easier and faster information sharing. This facilitated a more coherent collaboration with and participation of TEPCO in the Joint Council for Nuclear Emergency Response (JCNER) at the off-site ERC which was intended for the coordination between the hierarchical layers. It consisted of the prefectural and the local NERHQs and NEPHQs on the one hand, and the Fukushima Prefecture Headquarters for Disaster Control on the other hand. The local and prefectural NERHQs were under control of the METI Senior Vice Minister Motohisa Ikeda appointed to Director General, while the latter was directed by the Governor of Fukushima who issued the first evacuation for a two kilometers radius from the plant unlike the subsequent ones which were ordered by the Prime Minister[12].

All Japanese authorities and organizations including the police department, public services and the media were somehow related to the public as they ought to inform the citizens, guarantee their security, support them during the evacuation process and provide them with housing, medical care, food, and drinking water. In this very relation, the media was used as a tool by governmental and local bodies for crucial announcements, sharing relevant information and broadcasting press conferences to the domestic public and foreign states[13].

4.3.2 Legal Basis

Section 4.3.1 presents the most important actors that were involved in the management of the Fukushima nuclear crisis. Several legal acts and regulations determine a legislative framework in which crisis management should have been conducted. The most important is the Japanese Atomic Energy Basic Act, passed on December 19, 1995, which sets basic guidelines and standards for the utilization of nuclear energy. It prescribes that nuclear energy should exclusively serve peaceful purposes while ensuring safety at all times by being utilized independently from political bodies. As it serves as the most important legislative framework for nuclear safety, Japan attaches highest value to this policy document.

[11] Additional institutions are to be taken from Figure 7.
[12] This shift in responsibilities will be analyzed in Chapter 5.
[13] Chapter 4.2.3 highlights the most important entities and relations of crisis management during the Fukushima nuclear accident for legibility reasons. However, we strongly recommend to examine Figure 7 in more detail. Furthermore, it should be kept in mind that within the public several groups got involved in the crisis management on a voluntary and independent basis.

The Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors (=Reactor Regulation Act), having become effective on June 10, 1957, contains safety regulations that ought to be controlled and guaranteed by governments and operators. Besides, it provides for licensing criteria for the permission of the construction and the operation of a nuclear reactor. More detailed criteria are to be found in the Electricity Business Act (passed on July 11, 1964) which regulates the whole Japanese electricity sector.

According to these regulations and laws, the METI is the main authority responsible for all nuclear power facilities. This implies regulatory activities concerning the construction, operation and inspection of nuclear power facilities in Japan. NISA, as subsidiary organization of METI, is assigned the process of ensuring safety of nuclear energy and supports METI in the above mentioned activities.

The other regulatory body in the realm of nuclear energy is the NSC, bound to the Cabinet, which acts independently from other political bodies. It is responsible for the supervision and audit of safety regulations and is allowed to make recommendations. Moreover, the NSC established guidelines for the evaluation of safety review and assessment and built the JNES for technical support.

Finally, MEXT takes over the monitoring activities to encounter the risk of radiation damages and to evaluate possible releases of radioactivity. To this end, the ministry developed bodies and tools that facilitate the evaluation of dose limits.

In the context of the Fukushima crisis, the actors responded to the nuclear accident in compliance with the Act on Special Measures Concerning Nuclear Emergency Preparedness (Government of Japan 2011). This act was passed on December 17, 1999, and defines the communication chain form the operator to the METI and local government to the Prime Minister, the need to declare a nuclear emergency situation if anomalies at the plant exceed a manageable level, the establishment of NERHQs and the JCNER, and finally measures to prevent the worsening of the nuclear disaster. The measures comprise evacuations of the affected area which are intended to be issued by local governments and information sharing among all involved actors.

4.3.3 Crisis Management During the Nuclear Accident

The crisis management of the nuclear accident in Fukushima can be split up into the following stages: Stage 1 from the occurrence of the earthquake and the tsunami to the declaration of a nuclear emergency situation on March 11; Stage 2 from March 12 to March 22 comprising the evacuation of the region and its stepwise expansion in response to acute events at the plant; and Stage 3 from March 23 to May 31, the time-span when the situation at the NPS stabilized according to the Japanese Government enabling

officials to start with urgent reconstruction measures and extended monitoring programs of food, seawater, environment, air, soil and the deposition of the radionuclides Iodine[14] and Caesium[15].
Below, the three stages will be briefly recapitulated. A detailed analysis of the responsibilities of the different actors will be conducted in Chapter 5.

a) Stage 1: From the earthquake to the declaration of a nuclear emergency situation on March 11

Soon after the developments at the NPS became known, the evacuation of a three kilometers radius around the Daiichi NPS and the establishment of an in-door area within a ten kilometers radius were directed. At that time, no release of radiation was reported. In order to be able to response more easily to any kind of negative development at the plant, the former Deputy Chief Cabinet Secretary for Crisis Management Yukio Edano established an Emergency Response Office at the Prime Minister's Office right after the accident. In addition, the former Prime Minister Naoto Kan declared the nuclear emergency situation soon after first information about the plant's status reached the authorities.

b) Stage 2: Evacuation of the region in response to events at the plant (March 12 - March 22)

In response to an explosion at the site on March 12, Kan extended the initial evacuation area from a three kilometers radius to ten kilometers around the Daiichi plant. The explosion heightened the risk of the citizens' exposure to radioactivity. This is why the Prime Minister directed to prepare the distribution of iodine which is intended to prevent the accumulation of radioactive substances in organs essential for survival.
The evacuation zone was again expanded to a radius of 20 kilometers after new explosions at the plant were reported on March 15. Besides, officials announced an evacuation warning within a ten kilometers radius around the NPS into the sea. The same day an aftershock with a magnitude of 6.1 hit Japan but had relatively few consequences.
From March 17 onwards, responsible bodies measured radioactive dose rates all around Japan on a daily basis. In Tokyo being situated about 300 kilometers in the south of the Fukushima Daiichi NPS no radiation was measured at that time. This may have been caused by winds constantly moving off the Japanese coast to the west coast of the US. In contrast, high radiation doses were detected near the plant (up to 58 kilometers from the NPS) including the detection of contaminated food which drove the authorities' decision to recommend the ingestion of iodine to residents leaving the 20 kilometers evacuation zone. First food restrictions were directed for some prefectures which spanned seafood and seawater as of the end of March.

[14] Iodine occurs both as unstable radioactive and stable nonradioactive isotopes. In order to prevent the accumulation of radioactive iodine in the thyroid, nonradioactive iodine ought to be ingested. Radioactive Iodine (I-131) has a half-life of only eight days but can do severe harm to children and young people radioactive isotope.
[15] In contrast to Iodine, Caesium has a half-life of 30 years. It deposits in the soil which makes it highly dangerous for vegetation and cultivation over decades.

c) Stage 3: Stabilization of the situation at the NPS, reconstruction measures and monitoring (March 23 - May 31)

On March 23, the Japanese Government stated that the plant would be stable enough to begin with discharge work of low level radioactive water into the sea with the purpose of creating more storage capacity for highly radioactive water. On April 7, Japan suffered another aftershock with a magnitude of 6.6. Though, again, it did not worsen the situation at Fukushima Daiichi NPS. On April 12, the INES ratings were adjusted to Level 7, effective for the whole facility, resulting from an estimate of the total amount of radioactivity released to the environment. Accordingly, the Prime Minister disposed the establishment of a 20 kilometers no-entry zone around the site.

5 Analysis

Many scholars state that the crisis management in Fukushima in 2011 was not adequate especially when it came to crisis communication among the many actors involved (e.g. Funabashi et al. 2012; Norio et al. 2011; 't Hart 2013). By exploring the hypotheses, the following chapter aims at disclosing the mechanisms and processes that affected the crisis management and it analyzes why this did not contribute to successful satisfaction of the six components of adequate crisis management (Inspectie voor Veiligheid en Justitie 2012; Boin et al. 2005). In this manner, the aim of the analysis is to arrive at a full-fledged evaluation of the adequacy of crisis management during the Fukushima nuclear accident in 2011.

5.1 Level of Politicization

Based on findings from the literature, it was hypothesized that a higher level of politicization results in a more adequate crisis management given that the crisis has been properly recognized and signaled as such, and that it has been communicated domestically and abroad. As described in Chapter 3.3.2 this hypothesis is analyzed by a measurement of the mechanisms mediatization and level of disagreement among society. Since politicization appears both within and beyond the Japanese borders, the mechanisms have to be analyzed by Japanese and international data.

Theory departs from the assumption that adequate crisis management starts with an appropriate framing of the crisis (Boin et al. 2005; Weick et al. 2005; Koppenjan et al. 2004). The nuclear accident in Fukushima 2011 was never identified as nuclear crisis caused by human error. Rather, high-level politicians of the Japanese government, such as the former Prime Minister or the former Chief Cabinet Secretary, framed the nuclear accident in terms of an "environmental contingency" (Government of

Japan 2012) and as an unprecedented "series of tragedies that followed the Great East Japan Earthquake" (ibid.[16]). This framing made it easy to hide from confessions of guilt on the part of the government by arguing that the earthquake's intensity was not as predictable as the tsunami and the developments at Fukushima NPS[17]. It is striking that the authorities trivialized the actual gravity of the situation to the Japanese society as statements by high representatives show (cf. Appendix A).

Surely, a government always has to trade off accuracy of information provision against avoiding panic provoked by too detailed information. Yet, the Japanese society definitely received to little information with considerable time lags about the status of the nuclear reactors, the measures taken so far and the related health risks. Thereby, the Japanese government prioritized its self-interest of preserving good reputation while putting the public in jeopardy. This aspect is attributable to Japan's character as individualist society (cf. Chapter 4.1). The government wanted to let the population believe that it was in full control of the situation at any given time. To this end, authorities used the national and international media to transfer this image. In addition, radio stations, newspapers, television and the Internet were urged to transmit the latest news which remarkably diminished their scope for criticism and the capacity to insert pressure inducing mechanisms such as blame games. To put it in a nutshell, the domestic population was not capacitated to exert pressure on the decision-makers due to misused mediatization. The only recorded criticism from the public that reached the Government through counseling services established by several ministries and national actors for this purpose was about the character of the provided information. It was too technical and difficult to understand but there is no clue about criticism on the crisis management itself which might be either a consequence of the particular framing of the crisis and the small amount of information that reached the public, or a result of the simple acceptance of hierarchy as important cultural value of Japan (Hofstede et al. 2010).

Similar observations derive from an analysis of foreign media. Politicians from all over the world (e.g. USA, Germany, France, Australia, etc.) and high representatives of international organizations such as the UN, the WHO or the IAEA condoled with Japan and rather offered all kinds of support instead of passing criticism on the way the crisis had been managed and communicated up to that point. Just as within the country, the Japanese government used foreign media via press conferences and self-written articles to highlight the successes it was already able to achieve, and to downplay the nuclear accident as tragic disaster that was portrayed as having affected only a minority of the Japanese population, though. Subsequently, the international realm was equally averse or simply had no other possibility than not to hold certain decision-makers accountable for their actions. In the aftermath, especially scholars

[16] The related articles were published in the Washington Post on April 17, 2011 and in the International Herald Tribune on April 16/17 and April 30/May 1, 2011.

[17] Prime Minister Naoto Kan admitted that the earthquake brought about a much more intense tsunami than expected since the backup-system did not work properly at that time ("Prime minister Naoto Kan Addresses Japan" March 12, 2011).

analyzed the crisis management and second-guessed the actors involved in the crisis management for having made great failures which were deliberately trivialized or shifted to other actors.
At first, the Prime Minister was reluctant to engage with the press and publicized new information only through the IAEA until he and other actors realized the accident generated considerable attention from overseas which made the disaster indeed an internationalized crisis. According to theory (Rosenthal et al. 2001), this makes it very difficult to hide a crisis from the world, so that the actors of the crisis management network became more transparent and held daily press conferences and interviews. Relevant developments at the plant, counter-measures taken and related issues such as the evacuation process were subject of the press conferences and meetings with diplomatic corps.
Another finding emanating from the data analysis is that discussions among the foreign public were more critical which, however, only esulted in a criticism on nuclear energy as such and the respective policies within the different countries. The criticism was barely related to the specific crisis management of the Japanese government and other involved actors.

The analysis of evaluation reports of the crisis reveals that the international community was provided with far more extensive real-time information than it was to the national public (cf. Appendix A). Additionally, it is striking, that the former Prime Minister Naoto Kan was incoherent in his statements to the Japanese public and to the international community. At home, he announced that his fundamental policy would be to abandon nuclear power, while he expressed his support for a continuation of nuclear power to the international audience.
The framing of the nuclear crisis as unfortunate disaster triggered by the earthquake did not allow for great dissent among society from which logically follows that mechanisms enhancing adequate crisis management could not be induced. Through purposeful interference with the domestic and foreign media, the Japanese government was able to control the responses to their crisis management. The incomplete crisis communication and signaling hindered politicization and mediatization from exerting influence on the crisis management.

Expectedly, the findings **verify the hypothesis** that appropriate crisis management in terms of the components *recognition and signaling of a crisis* and *crisis communication* are an indispensable pre-condition for the effectiveness of politicization in the national and international realm. If this pre-condition is insufficient, the mechanisms cannot positively affect crisis management.

5.2 Geopolitical Context

The second hypothesis underlying the present study assumes that geopolitical implications can stimulate the process of politicization if certain components of crisis management are sufficiently satisfied. These components are first and foremost appropriate crisis signaling and communication to the abroad.

The present study ought to test the effect of short-term geopolitical implications for countries that are directly affected by the nuclear accident through radiation release to the ocean or to the atmosphere which falls down to earth in the shape of rain. The analysis disclosed that again, as already concluded in Chapter 5.1, the information provision was only fragmentary which presented a huge obstacle for other affected countries and diminished their level of awareness. An example in this context is the discharge of contaminated water to the ocean which was not communicated in real-time neither on the part of TEPCO nor of the Japanese government so that other countries that in fact suffered from the nuclear accident in the short-term were aware of the dangers. The contamination of the ocean had more far-ranging consequences for the neighboring countries, especially for the consumption of seafood, the fishery sector and the export of all ocean related goods. Because of the delay in information provision and its trivialization, those countries were not given the chance to prepare properly and to immediately react to higher radioactivity doses which they criticized in the aftermath (Norio et al. 2011).
The Japanese government underestimated the geopolitical implications of the crisis which is why they did not address the international community in an adequate fashion as shows, inter alia, the analysis of the mediatization and the politicization of Chapter 5.1.

Another dimension that needs to be analyzed in the context of geopolitical implications is the long-term development of nuclear energy policy worldwide which allows for drawing comprehensive conclusions on the adequacy of Japan's crisis communication and signaling (Wittneben 2011). The analysis of official statements, newspaper articles and secondary literature[18] demonstrates that in some countries a change of nuclear energy policy was in fact induced by the Fukushima nuclear accident. Yet, the responses differed strongly which does not allow for a generalized statement of the effect of long-term implications.
For the analysis of the long-term implications around the world we picked some of the world's biggest nuclear electricity producers at the time of the accident which were the USA, France, Germany, Russia, China, and South Korea (cf. Appendix C). All of these countries suggested safety reviews of their nuclear power plants and a reassessment of their safety criteria as a response to the nuclear accident in Fukushima (Akiyama et al. 2012). With the only exception of Germany (Wittneben 2011), the representatives of the countries argued explicitly in favor of nuclear energy and announced that there will be no change in their respective nuclear energy policy even if the public raised strong concerns against nuclear energy as in France[19] or South Korea. This trend is confirmed by developments within the IAEA right after the accident. An agreement on an action plan about new safety assessments should be passed but was rejected by newly emerging countries which were about to increase their nuclear-electricity production (ibid.). Figures 8 and 9 compare the status of commercial nuclear power two years

[18] A detailed overview of the utilized sources is given in Appendix A.
[19] 77% of the French people favored the abandoning of nuclear power (Akiyama et al. 2012).

before and after the Fukushima nuclear accident[20]. This comparison supports the findings from the data – the biggest nuclear-electricity producers adhered to nuclear power and even constructed new plants, while smaller producers became more reluctant to the production and use of nuclear power which partially was caused by strong criticism from society.

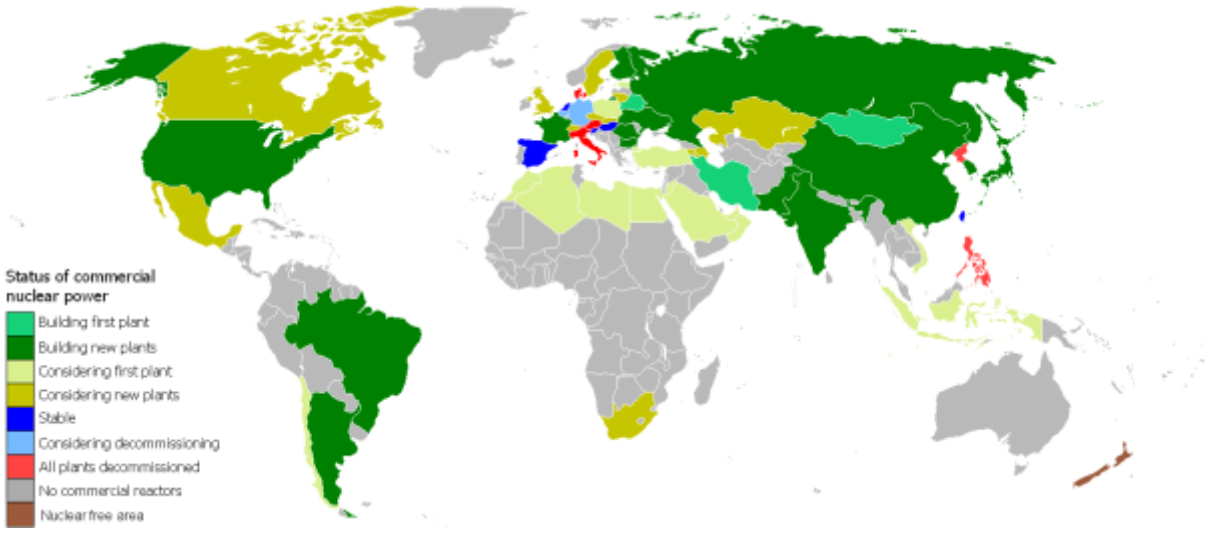

Figure 7: Status of commercial nuclear power 2009 ("Nuclear energy", n.d.)

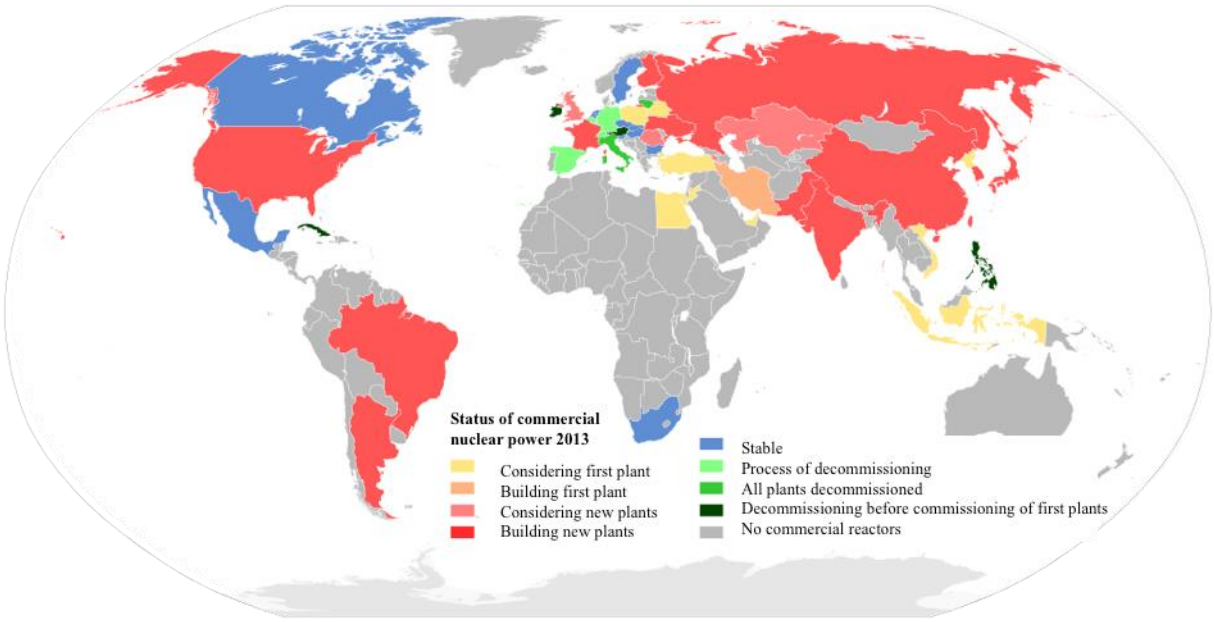

Figure 8: Status of commercial nuclear power 2013 ("Kernenergie nach Ländern", 2016))

The findings on the variable short- and long-term geopolitical implications further clarify why a more adequate crisis management through strong politicization processes could not be achieved. The biggest nuclear-electricity producers that are presumed to be as powerful as to exert pressure on the Japanese decision-makers highlighted the importance of nuclear power and rather focused on their own safety

[20] We would like to call the reader's attention to the differing colors of Figures 8 and 9. A careful reading of the legend is helpful for the understanding of the figures.

reviews instead of criticizing the Japanese crisis management. Yet, it is indispensable to take into account the manner in which the Japanese government communicated the crisis. The delay in reporting the intentional discharge and accidental leakage of contaminated water to the ocean hindered the international community from taking immediate measures. The Japanese government took great care of which information were being publicized that might have manipulated veritable crisis signaling and communication. This led to a process of one-sided geopolitical implications: The accident simply triggered the discussion of nuclear energy within other countries without creating spill-over effects that could have led to a more adequate crisis management in Fukushima.

Summarizing, the present study shows that crisis communication and signaling of the crisis are a necessary prerequisite for inducing a politicization process. Contradictory to the initial assumption, geopolitical implications did not positively affect the hypothesized politicization process as, on the one hand, communication on the part of Japan was not adequate which led to a partial lack of knowledge of the crisis, and, on the other hand, important countries with the ability to exert pressure on Japan did not change their ways of thinking in the context of nuclear power. Hence, the Fukushima nuclear accident evidently was an internationalized crisis and had geopolitical implications, whose power could not be led back to the hypothesized circle of the variables *adequacy of crisis management*, *geopolitical implications* and *level of politicization*. **The cyclic relation is not traceable from the data analysis**.

5.3 Improvisation from Protocols

Deriving from theory, the third hypothesis assumes that improvisation from protocols can have both a positive and a negative effect on the adequacy of crisis management, depending on the particular components of the dependent variable. As was hypothesized that improvisation in the analysis, judgment, preparation and conduction of decision-making, and steering of the crisis enhances adequate crisis management, while adherence to protocols is necessary to ensure a clear structure and responsibility assignment as well as adequate preparation and provision of information within the crisis management organization. This is presumed to be an indispensable feature of guaranteeing safety and health of all affected people right after the occurrence of the accident.

The analysis of three official reports that evaluated the crisis and crisis management from an aftermath perspective unfolded the important finding that the emergency protocol for nuclear accidents in Japan was not prepared enough for such a disaster as it occurred in 2011 (Funabashi et al. 2012; The National Diet of Japan 2012; ‘t Hart 2013). The Independent Investigation Commission summarized the crisis management as highly improvised in many different terms (The National Diet of Japan 2012). Only

during the first few hours the chain of command as directed in the emergency protocol was complied with, but only with regard to the chain of signaling of the crisis[21].

It turns out that the unpreparedness stemmed from the presumption that the concurrence of an earthquake, a tsunami and a severe nuclear accident would be highly unlikely to happen which is why there was no real emergency plan for such a case. This contradicts Hofstede's assessment of Japan as one of the most uncertainty avoiding countries in the world (cf. Chapter 4.1) since this would imply that a country is prepared for every case no matter how unlikely. This cannot be accepted as true for the Fukushima nuclear crisis so that the index of uncertainty avoidance must be rejected as inapplicable to the case of Japan's nuclear crisis from 2011.

At this point, we can conclude that a country that is highly exposed to natural disasters has to be prepared for a crisis where a nuclear accident can be triggered by natural disasters. The safety systems at the Fukushima NPS[22] and the inadequate location of the off-site ERC are only two examples showing that at least a tsunami was not considered as hazard source and made full improvisation of the crisis management necessary. Furthermore, the responsibilities were shifted during the process of crisis management so that the initial protocol which assigned certain responsibilities to actors (primarily to ministries and their subsidiary organizations) was not complied with. To give an example, the evacuation of the affected area was assigned to local and prefectural entities as they were presumed to have best knowledge about the needs and capacities of their regions. The first evacuation was in fact issued by the Governor of Fukushima immediately after the tsunami, but was turned into a responsibility of the Prime Minister afterwards. The following evacuation orders were all issued by Naoto Kan who was lacking significant expertise. Residents had to move multiple times and to areas with high radiation levels as several facilities built for nuclear emergencies were too close to the NPS which unnecessarily exposed residents to dangerous radioactivity[23]. This created a remarkable level of confusion not only among society, but also within the crisis management network. Because of a deficient emergency infrastructure, the communication between the off-site ERC and the offices in Tokyo did not work properly, so that the evacuation orders reached the municipalities at different times. Thus, the actual evacuation was executed fragmentarily and with high uncertainty-creating potential on the parts of the residents.

[21] The power plant's operator TEPCO informed NISA and METI about the accident. They, in turn, informed the Cabinet about the developments.

[22] This is meant with regard to the location of the emergency diesel generators of all six reactors with exception of one single generator at Unit 6. All were located in the basements of the containments which made them highly vulnerable to any kind of flooding. Since the plant is situated directly at the coast and the occurrence of tsunamis is not unlikely, a more adequate positioning of the emergency generators should have been considered. Before the accident, experts from the Society of Civil engineers made the licensee aware of this risk but TEPCO refused to take protective measures because of the fear of losing trust among society (The National Diet of Japan 2012).

[23] Approximately 150.000 people were evacuated, whereof 60 patients died because of evacuation complications (The National Diet of Japan 2012).

The communication problem pervaded other spheres of the crisis management – the information sharing with the national public was incoherent and often times delayed since all involved actors gave separated briefings and held separated press conferences from each other, partially with huge differences in facts. Further improvisation from the insufficient emergency protocol was needed with regard to health care. The guidelines for the distribution and injection of stable iodine were not detailed enough and gave no advice about the necessary quantity or specific dates of distribution. It was unclear whether the injection should be obligatory or voluntary and who should be responsible for the distribution.

All the described aspects are examples for high levels of improvisation from protocols which made the crisis management inadequate. The lack of preparation might have resulted from cultural issues as it turned out during the analysis that NISA as part of METI knew about the lacking preparedness for accidents of TEPCO at the NPS but did not sufficiently report to the Government. This is explainable by Japan's individualist peculiarity which implies the pursuit of self-interest. As METI is the Ministry of Industry, this inference seems to be logic.

All in all, **the findings verify half of the initial hypothesis** that improvisation from protocols in emergency situations negatively affects the adequacy of crisis management. From the case of Japan, however, one can learn that high levels of improvisation do not enhance the adequacy.

5.4 Interagency Collaboration

In the context of hypothesis 4, it was assumed that a higher level of interagency collaboration positively affects the adequacy of crisis management. Interagency collaboration is understood as collaborarchy implying hierarchy in structure and collaboration during the crisis management process (Bardach 2015). Regarding the Fukushima nuclear crisis, scholars criticized that the Prime Minister took over too many responsibilities already during the first few hours after the accident, although he did not have enough expertise to fulfill the tasks in a satisfactory manner. Expertise is one factor besides available time and resources why interoperability and specialization is an adequate way of managing a crisis. The analysis aims at clarifying why interagency collaboration failed so soon during the Fukushima crisis and which consequences that had for the adequacy of crisis management, especially for the dimension *provision of information within crisis organization*.

As analyzed in Chapter 5.3, an immense problem that influenced the whole process of crisis management was the lack of a real emergency plan. This also affected the interagency collaboration since the responsibilities were not made explicit enough in the plan. As a consequence, the boundaries of role definitions and responsibilities were problematic as the partly overlapped. The analysis of the information sharing with outsiders shows that all ministries and other involved actors such as the power plant's operator TEPCO held separated press conferences and briefings, and published own documents

about the status of the plant with (partially) mistaken facts. But not only the information sharing to the public was poor; also the information provision within the crisis management network stopped functioning right after the signaling of the crisis. The chain of command was mainly disrupted by the Prime Minister after the first explosions at the plant when Kan lost trust in the truthfulness of the reports of TEPCO (Funabashi et al. 2012; The National Diet of Japan 2012) and experienced difficulties of real time information sharing among all actors. The last point can in parts be imputed to the damaged infrastructure. However, as was concluded in Chapter 5.3, a country that is naturally exposed to earthquakes and tsunamis has to prepare necessary resources for times of crisis.

The emergency plan originally assigned the leading role to the regulatory body NISA according to the Act on Special Measures Concerning Nuclear Emergency Preparedness (cf. Chapter 4.3.2) which soon became overburdened. Little by little, the Prime Minister centralized the whole crisis management around his office with the argument that regional, prefectural and local entities were already fully busy with the response to the earthquake and the tsunami. Hence, the Prime Minister's tasks ranged from issuing evacuation orders to municipalities and prefectures, technical monitoring at and around the site, directing technical orders to the on-site emergency workers, and informing the national and international public. Consequenty, the Prime Minister's office was totally busy which considerably slowed the particular actions down and deteriorated the whole governance of the crisis. As a response, Kan reordered responsibilities five days after the occurrence of the accident and established the Government-TEPCO Integrated Response Office without having legal authority while remaining the centralized approach (Government of Japan 2011).
However, the newly established hierarchy was not accepted by all actors – the regulatory bodies NSC and NISA and the licensee TEPCO made decisions about technical measures at the plant separate from the Prime Minister. The organization chart in Chapter 4.3.1 shows the complex and mazy crisis management network that developed throughout the process.
After having analyzed that the relation between TEPCO and the nuclear power promoting ministry METI with its subsidiary organization NISA might bypass ordinary legal regulations (cf. Chapter 5.3), the solo of exactly the same actors appears highly problematic for the adequacy of crisis management. Combined with Hofstede's categorization of Japan as individualist and masculine society, once more it becomes conclusive that self-interest, the pursuit of reputation and the related fear of being hold accountable for the accident, as well as the strong sense of competence distorted the crisis management during the Fukushima crisis.

Recapitulating, one can conclude that the intended roles and responsibilities of the actors were disrupted by the Prime Minister who centralized the whole process of crisis management to his office. This did not enhance the adequacy of crisis management because of significant lacks of expertise and resources. All attempts on the part of the Prime Minister to reorganize the crisis management network to a more

effective organization were in vain and exacerbated the lack of transparency and mistrust between the involved actors. The need for interoperability was not satisfied and caused decisions on the basis of missing expertise.
Institutional vulnerabilities through inappropriate relationships between regulatory bodies and TEPCO made the issue of the public's safety subordinate while prioritizing their own interests ('t Hart 2013). One can reason that individualist and masculine values within a society turn interagency collaboration in times of a crisis into a huge challenge which is one cause why the crisis management in Fukushima did not work out as intended.

Hence, the analysis has shown that the hypothesized relation between interagency collaboration and adequacy of crisis management **might have been verified if** there had been a real collaboration rather than centralization.

5.5 Cultural Background

On the basis of Hofstede's cultural index (2010), it was hypothesized that, on the one hand, the cultural categorization of a country presents a good framework aiming at a better and more appropriate understanding of the management during a certain crisis, and, on the other hand, cultural values affect crisis management. This hypothesis could be verified by the analysis of the independent variables *level of politicization*, *geopolitical context*, *improvisation from protocols*, and *interagency collaboration*.

The research reveals that the simple acceptance of hierarchy in the context of the index *power distance* prevent the public from passing criticism on decision-makers and hold them accountable for their actions. In this way, politicization cannot exert enough pressure on the authorities to make the crisis management more adequate.
It turned out that individualism and the related self-interest at the expense of the people's health and safety make interagency collaboration extremely complicated, especially in combination with masculine values like competence. Together, individualism and masculinity form an explosive mixture for adequate crisis management.
Hofstede (2010) categorized Japan as one of the most uncertainty avoiding and long term oriented countries in the world. However, this does not hold for the case of Fukushima. Albeit being regularly exposed to all kinds of natural disasters, politicians and nuclear power plant operators were not prepared for a nuclear accident which is triggered by both an earthquake and a tsunami case. This contradicts Hofstede (2010) and is therefore not applicable to this research.
Finally, Japan's peculiarity as restraint culture in the workplace could not be applied to this research either, which only allows for assuming that this might be helpful for crisis management as crises usually are characterized by stress and pressure in which, nevertheless, rational thinking is indispensable.

To summarize, first, the **analysis verifies the hypothesis** that the cultural categorization contributes to a better understanding of why Japanese politicians and other actors involved acted like they did since it is important to evaluate crises in the light of prevalent cultural values. In contrast to what many scholars assume, it is not possible to simply apply Western values to an Asian country and to use them for the explanation of certain aspects. Second, it can be verified that cultural values in fact influence crisis management which is why they cannot be split from the analysis thereof. In the case of Japan, these cultural values had mainly negative effects on the crisis management.

6 Conclusion and Discussion

The present study explored the relation between the impact of culture on crisis management by means of a case study of the Fukushima nuclear accident in Japan in 2011. This relation was scrutinized by testing the effects of the variables *level of politicization*, *geopolitical context*, *improvisation from protocols*, and *interagency collaboration* on crisis management.
Incurring theoretical and practical implications as well as strengths and weaknesses of the research design, this chapter answers to what extent and how the cultural background affected the adequacy of crisis management concerning the meltdown of the Fukushima nuclear reactor after the tsunami in 2011. Furthermore, it discusses the general conclusions and results that can be drawn from the present study, before providing recommendations for future research.

6.1 General Conclusions

First and foremost, the exploration of the five hypotheses showed that adequate crisis management starts with a good system of crisis signaling and communication to the domestic public and the international community.

Initially, it was assumed that a high level of politicization, which is to be understood as the process of mediatization on the one hand, and the level of disagreement on the other hand, would result in a more adequate crisis management, but only under the condition that the crisis has been properly signaled and communicated. It turned out that Japan's decision-makers failed on exactly these two dimensions during the crisis which made the subsequent crisis management extremely complicated. Japanese representatives framed the nuclear accident rather as a tragedy caused by an extremely strong earthquake than admitting that the tsunami and a nuclear accident of such a severe extent had to be predictable and the respective response prepared. This framing did not allow for disagreement on the parts of society

which was further strengthened by the Japanese value of acceptance of hierarchy.[24] Along with intentional manipulation of the media and the spread of certain messages all over the world, the Japanese government was able to prevent harsh criticism on its crisis management. These findings demonstrate that the process of politicization was scotched very early, hindering it from taking the hypothesized effect. Thus, the hypothesis can be neither verified nor falsified as the analysis of evaluation reports and secondary literature indicated that already the early stages of crisis management (crisis signaling and communication) were highly deficient.

The same applies to the second hypothesis which supposed that geopolitical implications stimulate politicization if a crisis is appropriately signaled and communicated to the abroad. Although the analysis disclosed that nuclear accidents do not cause the expected stir and results in changes in foreign nuclear energy policies, we can conclude that severe nuclear accidents have the power to create a remarkable level of distrust in nuclear power among the public, even if their state-leaders insist on the continuation of nuclear energy production. Hence, it is to be assumed that the public and scholars form the engine that can exert pressure on decision-makers, while politicians around the world are more reluctant to pass criticism. Moreover, the study revealed that important information for neighboring countries on, for instance, the leakage and the purposeful discharge of radioactive water into the ocean was withheld by the operator TEPCO and the Japanese government. This shows that the actors were not aware of the great scope of the nuclear accident.

The variable *improvisation from protocols* was analyzed on the basis of evaluation reports from different sources to reconstruct the crisis management how it was planned and how it actually turned out. It was hypothesized that improvised crisis management is adequate for active crisis management, while adherence to protocols is necessary for having a clearly structured network thereof. The analysis resulted in the finding that, firstly, there was no real plan at work suggesting that Japan's politicians and nuclear power plants' operators were not prepared for a nuclear accident. Secondly, the existing poor planning was abandoned by the former Prime Minister already during the first few hours after the accident, initiating full improvised crisis management from that time onwards with severe consequences for residents. As most of the scholars agree that the crisis management was highly inadequate, one can conclude that for all spheres of crisis management it is more effective to stick to a protocol if this protocol was carefully compiled. The initial hypothesis is partly verified.

In contrast, the analysis in the context of the fourth hypothesis led to a verification of the assumption that a high level of interagency collaboration enhances adequacy of crisis management. As intersubjectively agreed upon, the crisis management during the Fukushima nuclear accident was not adequate. One reason might have been the poor level of interagency collaboration caused by

[24] This refers to Hofstede's power distance index.

infrastructural damages and resulting communication problems, deficient emergency protocols, poor preparedness of all involved actors, competence among the actors, and full centralization of crisis management around the Prime Minister soon after the accident. The centralization to an authority which was lacking technical expertise but engaged in orders containing technical measures turned out to be completely inadequate. Besides lacking interagency collaboration, missing expertise seeded confusion among the Japanese society.
On the basis of these findings, one can assume that better interagency collaboration would have positively affected crisis management.

In part, the conclusion points at certain values that influenced the crisis management in Japan. Generally, the present study contributes to fortify the argument that culture conditions mechanisms of crisis management. Especially, the distinct elements of masculinity and individualism in Japan showed to be an obstacle for interagency collaboration and effective crisis management, prioritizing the people's health and safety. Furthermore, the acceptance of power distance impedes criticism which is necessary for the relation between politicization and adequacy of crisis management.
Yet, the analysis produced the conclusion that Hofstede's (2010) categorization of Japan as one of the most uncertainty avoiding countries in the world does not hold for the analysis of the nuclear accident in Fukushima as actors mainly failed in the preparation of crisis management.

By means of the presented findings, the present study contributes to a refining of the analysis on adequacy of crisis management by incorporating the cultural dimension which is as necessary for the research on crisis management in a specific country as initially expected. Furthermore, in terms of scientific relevance, the study suggests that theory should not simply attach a unique character to every single crisis since we have shown that generalizable preparedness rather than improvisation is an indispensable feature of crisis management. On top of that, we recommend a revision of Hofstede's (2010) cultural indices on the basis of this study as we were able to demonstrate that some of his dimensions are not applicable to the Japanese method of operation. A strong point about the study is its complex construct of causal paths that allows for a full-fledged evaluation of the Fukushima crisis management.

6.2 Limitations and Recommendations for Future Research

Other than expected, the formulation of the hypotheses did not perfectly fit the theoretical framework of the study. It would have been more reasonable to formulate the hypotheses in a way that the relations are negative rather than positive. This would have raised the study to a higher level of intelligibility and would have assured a more appropriate hypothesis-testing. This study was confronted with measurement difficulties as several relations turned out to have failed at very early stages – almost always at the

preparatory stage of crisis management. Consequentially, the study could not test the exact hypotheses as was intended. For future research it is helpful to keep that in mind.
Moreover, the study was restrained by language issues. As the comprehension of Japanese was not given, the level of political disagreement in, for instance, parliamentary debates for the analysis of politicization could not be measured. This would be an interesting issue for future research, provided that Japanese was understood.
Regarding the appropriateness of the research design, we can conclude that for the analysis as is subject of this paper the approach of Realistic Evaluation of a single case study was the only possible option to research in depth. A multiple case study, albeit usually promoting reliability and generalizability, would not have been feasible as it does not allow for such deep analyses of specific mechanisms underlying crisis management. The main interest of the study was to broaden the Western horizon of crisis management into the direction of Asian countries and to identify problems and challenges for crisis management arising from a certain cultural background and values. This points at the societal relevance of the study since Asia bears multiple newly emerging countries in the realm of nuclear energy production which is why the research on crisis management in this cultural setting should be imperatively extended.
However, the present research made small contribution to this broad field, given the limited scope and the vast complexity of the study. It might have been helpful to concentrate on a smaller number of variables to be able to go more in detail.

Following this argumentation, we propose the analysis of inter-variable relations, as, for instance, the effect of improvisation from protocols on interagency collaboration for future research.
As the resources of the present study were limited, we could not analyze the effect of the crisis management for the natural disasters on the nuclear crisis management. Future research might look at the question of how much capacity actually was available after the response to the earthquake in order to evaluate the crisis management of the nuclear accident more sound standingly.
Finally, we suggest to conduct a full-fledged social and mass media analysis to gain further knowledge about the character of the politicization process during the Fukushima crisis.

Given the validity of the study, we have confidence that the striking results actually contribute to the research field of crisis management, even considering certain limitations.

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8 Appendices

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Appendix D: Overview of the Procedural Method

a) Topic List

Appendix E: Statutory Declaration

Appendix A: Information and Data Sources

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Appendix B: Research Protocol

In order to get access to official emergency preparedness and response plans for nuclear disasters by the Japanese Government, I contacted the responsible Nuclear Regulation Authority via a written letter and a verification of my request by my supervisor Prof. dr. R. Torenvlied (sent as e-mail on 1 May 2016).

a) Letters to the Japanese Nuclear Regulation Authority

Lisa Schneider
[redacted]
Germany
[redacted]

1st of May, 2016

Nuclear Regulation Authority (JCN 9000012110002)
[redacted]

Subject: Request for inspection of the official emergency preparedness and response plan for nuclear disasters

Dear Sir, Madam,

Hereby, I would kindly ask you whether I would be allowed to access to the official emergency preparedness and response plan for nuclear disasters in Japan.

I am a third-year student of the Bachelor's program „European Public Administration" at the University of Twente in Enschede, Netherlands. In the context of a research program in crisis response, led by professor of Public Management René Torenvlied, I recently started a Bachelor thesis research on crisis management.

In this research project I would like to study crisis management concerning the meltdown of the Fukushima nuclear reactor after the Tsunami in 2011.

For a proper analysis it would be important to have insight in the emergency preparedness and response plan for nuclear disasters developed by your institution in collaboration with the Japanese government *in advance* to the Fukushima meltdown. This would allow for deep and insights and lessons learned the process of crisis management in Japan.

After completion the Bachelor thesis will be published. No information will be published, however, that would be traceable to individual persons and all information will be treated confidentially.

Could you please let me know whether I could obtain insight in the plan? I sincerely hope that you are positive about my request. If so, could you please let me know how I could access the document?

With respect, yours sincerely,

Lisa Schneider

Lisa Schneider

UNIVERSITY OF TWENTE.

To: Nuclear Regulation Authority (JCN 9000012110002)
[redacted]

INSTITUTE FOR INNOVATION AND GOVERNANCE STUDIES

FROM	DATE	PAGE
Prof. dr. R. Torenvlied	29 April 2016	1 of 1
[redacted]	OUR REFERENCE [redacted]	

SUBJECT
Verification of a request to inspect the official emergency preparedness and response plan for nuclear disasters

Dear Sir, Madam,

You recently received a request from Lisa Schneider to inspect the official emergency preparedness and response plan for nuclear disasters for her research. Her study takes place within the context of a research program at University of Twente into crisis management. As a full professor in public management, I am the program leader of that research program.

The program builds upon recent crises in the Netherlands, for example the fireworks facory explosion in the city of Enschede, the crash of Malaysia Airlines, or hurricane Sandy striking New York.

In my position as the direct supervisor of the student Lisa Schneider and as the program coordinator of the Bachelor's program „European Public Administration" at the University of Twente in Enschede, Netherlands, I would like to verify the credibility of the request by Lisa Schneider.

I can confirm that the access to this document is of great value for our research program and for Lisa Schneider's Bachelor thesis research.

If you have any questions, please do not hesitate contacting me.

Respectfully,

Prof. dr. René Torenvlied

Professor of Public Management
Program Director

P.O. Box 217,
7500 AE Enschede
The Netherlands
www.utwente.nl

University of Twente (UT) is registered at the Dutch Chamber of Commerce under nr. 501305360000

As I did not get an answer to my letter, I called the authority in Japan on Wednesday 11 May 2016 and had a telephone call with Mrs. Kumiko Tsukada from the International Affairs Office of the respective agency. In response to the call, she provided me with the relevant URLs but stressed that the original

emergency protocols from before the Fukushima Daiichi accident disappeared as the former responsible organizations (NSC and NISA) were abolished in response to the accident. Nevertheless, I was able to access the former Emergency Preparedness Regulatory Guide with the provided URLs.

Appendix C: Full Description of the Case

a) The Functioning of a Nuclear Reactor

A nuclear power plant produces thermal power using one or multiple nuclear reactors for the conversion of heat into electro energy. Although various types of nuclear reactors have been developed, the principle of electricity production is more or less the same: the splitting of atoms generates heat, steam emerges which drives turbines in order to produce electricity. This process will be explained in more detail on the basis of a Boiling Water Reactor (BWR) as it was in use before and during the Fukushima nuclear accident in 2011.

The main components of a nuclear reactor are the containment, fuel, a moderator, control rods, a coolant, and a pressure vessel (Figure 9).

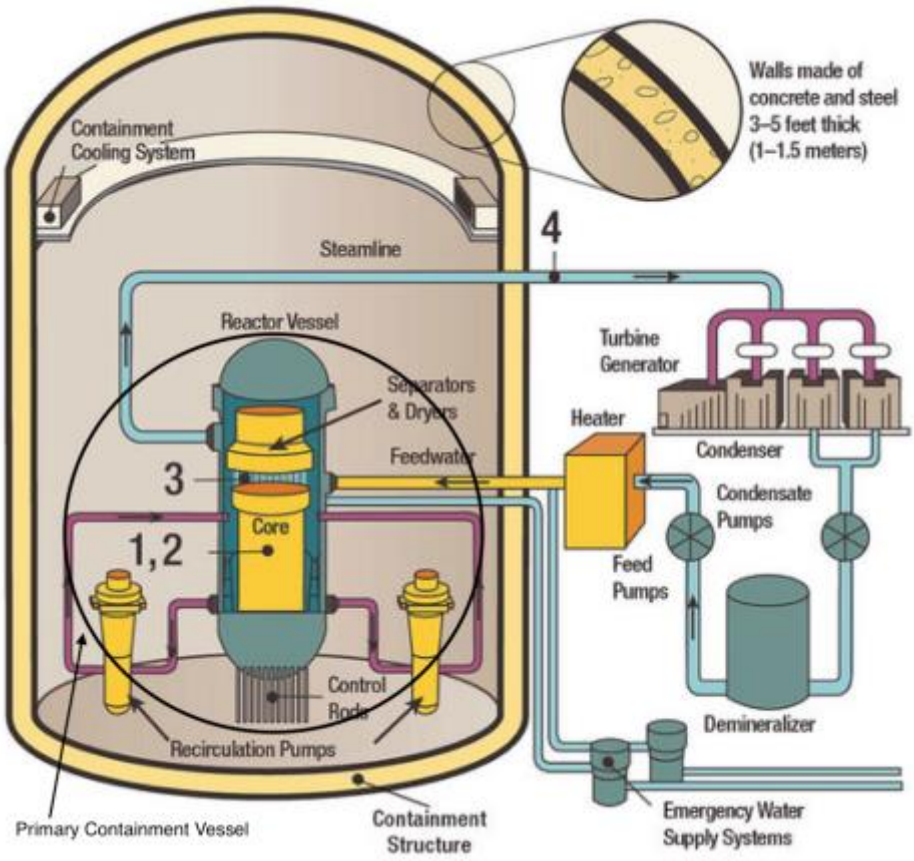


Figure 9: Nuclear reactor (United States Nuclear Regulatory Commission 2012).

The primary containment vessel (PCV) (also called drywell) is made of concrete and steel which ought to protect the inside from outside irruptions and the environment from radiation releases. This containment houses the reactor pressure vessel with the reactor core, and pumps which constantly pump water in and out of the reactor serving as coolant and moderator at the same time. Since the Fukushima Daiichi nuclear reactors use seawater for this purposes, it is pumped back to the ocean after having lost the radioactivity.

In the reactor core the nuclear process is carried out. Thin three to four meters long fuel rods contain up to 140 tonnes of fissionable Uranium nuclei with a melting point of 2800°C. Thermal neutrons being capable of producing fission reactions enter the Uranium core and fission the atoms. New smaller neutrons generated by this process typically escape from a new nuclear fission process as they move with an enormous speed and resulting energy release. With the intention to slow down the neutrons, water is injected in the reactor core. This moderating effect makes for triggering a chain reaction as every single fission process causes a new one. Yet, this would accelerate quickly, meaning that a huge amount of heat, pressure, steam and energy would be produced which could reach a dangerous level. To effectively encounter this risk, control rods can be inserted to and removed from the moderator at any given time. These rods are made of Boron or Cadmium which absorb neutrons. Consequentially, the number of spare neutrons and nuclear fission chain reactions can be controlled. Another measure to encounter high pressure is the discharge of condensed steam from the wetwell via the suppression pool to the drywell and the restriction of water flow through the core in order to reduce moderation.

As explained above, the fission reactions generate an enormous amount of heat. In response, the surrounded water gets heated up and changed to steam which is then used to turn the turbines. The generators finally turn this to electricity and allows for distributing it to external power distribution facilities. It is important to know that used fuel rods are moved to a spent fuel pool (Figure 10) until they stop releasing heat. The spent fuel pool continuously needs to be filled with water so as to fully cover and cool the fuel rods. If the cooling fails in the spent fuel pool or the reactor core, temperatures could rise to over 1200 degrees which may result in melting of the fuel rods.

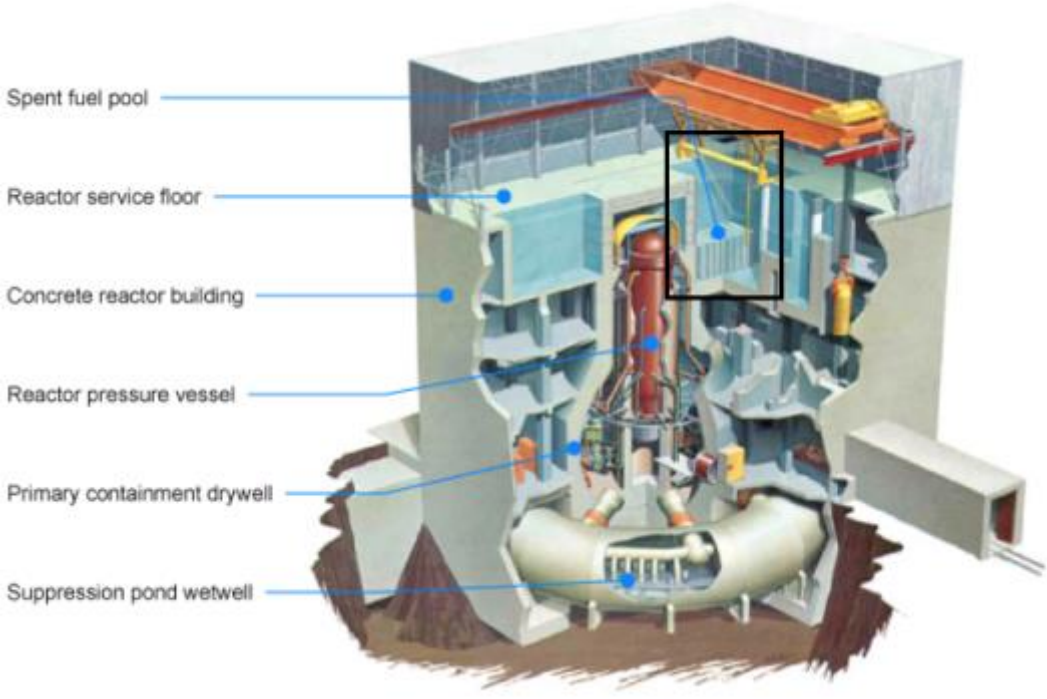


Figure 10: Containment with spent fuel pool (World Nuclear Association 2012).

b) The Exact Definitions of the Levels on the INES Scale

Ines Level	People and Environment	Radiological Barriers and Control	Defense-in-Depth
Level 7 Major Accident	Major release of radioactive material with widespread health and environmental effects requiring implementation of planned and extended countermeasures.		
Level 6 Serious Accident	Significant release of radioactive material likely to require implementation of planned countermeasures.		
Level 5 Accident with Wider Consequences	Limited release of radioactive material likely to require implementation of some planned countermeasures. Several deaths from radiation.	Severe damage to reactor core. Release of large quantities of radioactive material within an installation with a high probability of significant public exposure. This could arise from a major criticality accident or fire	
Level 4 Accident with Local Consequences	Minor release of radioactive material unlikely to result in implementation of planned countermeasures other than local food controls. At least one death from radiation.	Fuel melt or damage to fuel resulting in more than 0.1% release of core inventory. Release of significant quantities of radioactive material within an installation with a high probability of significant public exposure.	
Level 3 Serious Incident	Exposure in excess of ten times the statutory annual limit for workers. Non-lethal deterministic health effect (e.g. burns) from radiation.	Exposure rates of more than 1 Sv/h in an operating area. Severe contamination in an area not expected by design, with a low probability of significant public exposure.	Near accident at a nuclear power plant with no safety provisions remaining. Lost or stolen highly radioactive sealed source. Misdelivered highly radioactive sealed source without adequate procedures in place to handle it.
Level 2 Incident	Exposure of a member of the public in excess of 10 mSv. Exposure of a worker in excess of the statutory annual limits.	Radiation levels in an operating area of more than 50 mSv/h. Significant contamination within the facility into an area not expected by design.	Significant failures in safety provisions but with no actual consequences. Found highly radioactive sealed orphan source, device or transport package with safety provisions intact. Inadequate packaging of a highly radioactive sealed source.
Level 1 Anomaly			Overexposure of a member of the public in excess of statutory annual limits. Minor problems with safety components with significant defense-in-depth remaining. Low activity lost or stolen radioactive source, device or transport package.

Table 1: Definitions of Levels 1 to 7 on the INES scale (International Atomic Energy Agency, n.d.).

c) Summaries of the Status of Units 1 to 6 of the Fukushima NPS at Different Times

Fukushima Daiichi Summary Table - Units 1-6

Legend: No Immediate Concern | Concern | [illegible]

Unit	1	2	3	4	5	6
Power (MWe/th)	460/1380	784/2381	784/2381	784/2381	784/2381	1100/3293
Type of Reactor	BWR-3	BWR-4	BWR-4	BWR-4	BWR-4	BWR-5
Status at the time of event	In service – auto shutdown following earthquake			Shut down for outage before earthquake		
Core and Fuel	Damaged			No fuel rods	No damage expected	
Containment Integrity	No damage reported	Damage suspected	No information	Outage configuration	No damage expected	
Off-site power	[illegible]		[illegible]			
Diesel generators	[illegible]				Two emergency diesel generators powering Units 5 and 6	
Building	[illegible]	Slight damage	[illegible]		No damage reported	
Water level in reactor pressure vessel	[illegible]				Outage configuration	Above fuel
Pressure of reactor pressure vessel	Stable	Unreliable data	Stabilised	Outage configuration	No information	
Containment Pressure Drywell	No information	Stable	Stable	Outage configuration	No information	
Water injection to reactor pressure vessel	Sea water	Sea water	Sea water	Outage configuration	Not necessary	
Water injection to containment vessel	Not available			Not necessary		
Spent fuel pool temperature	No information				Stabilising	

Figure 11: Status of Units 1-6 at 19 March 2011 (Government of Japan 2011)

Fukushima Daiichi Summary Table - Units 1-6 (20 March 2011, 21:00 UTC):

Legend: No Immediate Concern | Concern | [illegible]

Unit	1	2	3	4	5	6
Power (MWe/th)	460/1380	784/2381	784/2381	784/2381	784/2381	1100/3293
Type of Reactor	BWR-3	BWR-4	BWR-4	BWR-4	BWR-4	BWR-5
Status at Time of Event	In service – auto shutdown following earthquake			Shut down for outage before earthquake		
Core and Fuel	Damaged			No fuel rods	Cold shutdown	
Containment Integrity	No damage reported	Damage suspected	No information	Outage configuration	No damage expected	
Off-site Power	[illegible]	[illegible]	[illegible]		Not available	
Diesel Generators	[illegible]				Two emergency diesel generators powering Units 5 and 6	
Building	[illegible]	Slight damage	[illegible]		No damage reported	
Water Level in Reactor Pressure Vessel	[illegible]			Outage configuration	Above fuel	
Pressure of Reactor Pressure Vessel	Stabilised	Unreliable data	Elevated	Outage configuration	Stabilised	Stabilised
Containment Pressure Drywell	Stable	Stable	Elevated	Outage configuration	No information	
Water Injection to Reactor Pressure Vessel	Sea water	Sea water	Sea water	Outage configuration	Freshwater injection in progress	
Water Injection to Containment Vessel	Not available			Not necessary		
Spent Fuel Pool Temperature	No information	Spraying from outside	Spraying from outside	Spraying from outside	Cooling restored	

Figure 12: Status of Units 1-6 at 20 March 2011 (Government of Japan 2011)

d) The World's Biggest Nuclear-Electricity Producers in 2009

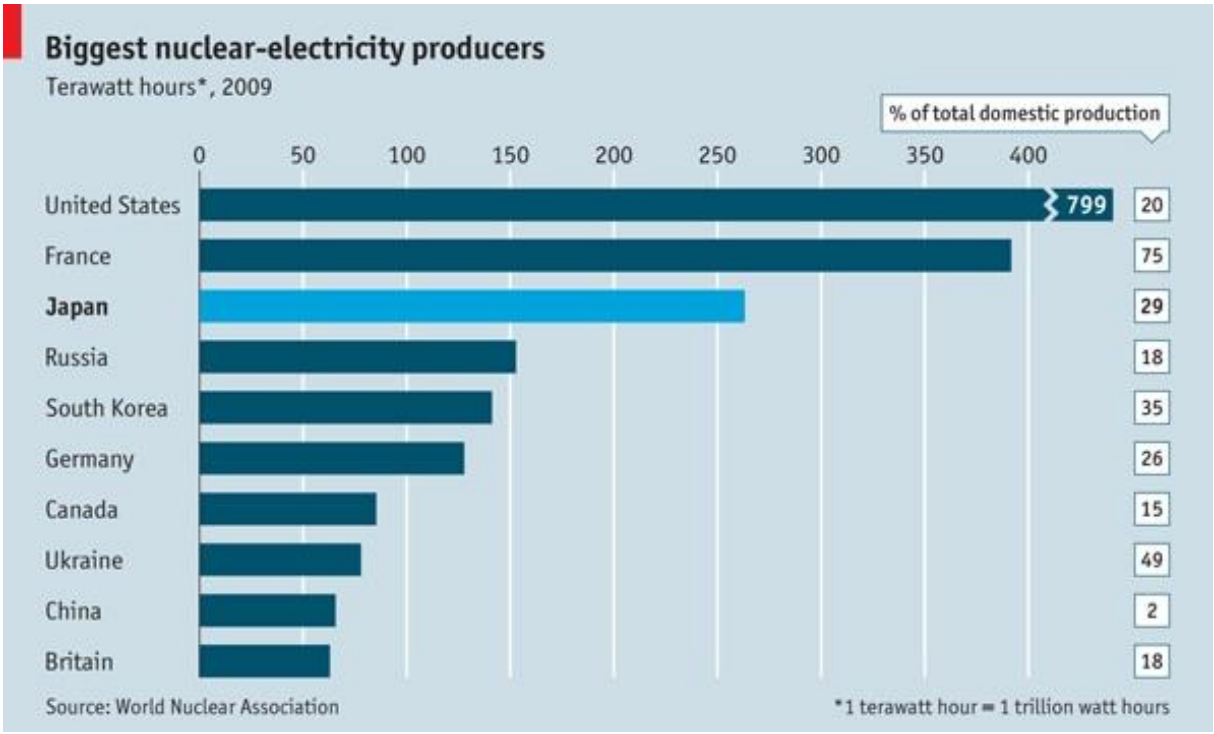


Figure 13: The world's biggest nuclear-electricity producers in 2009 (Merchant 2012).

Appendix D: Overview of the Procedural Method

a) Topic List

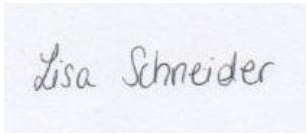
The following list contains keywords that were used to find constructs for the variables underlying this study:

Adequacy of crisis management
Consequences of nuclear accidents
Crisis communication
Crisis management (in Fukushima)
Crisis management network
Effect of culture on crisis management
Emergency protocol
Fukushima nuclear accident
Interagency collaboration
Mediatization
Nuclear crisis
Nuclear crises in Europe
Nuclear energy
Nuclear energy disaster
Politicization

Appendix E: Statutory Declaration

Statutory Declaration

I hereby declare that I have authored this thesis independently, that I have not used other than the declared sources, and that I have explicitly marked all material which has been quoted either literally or by content from the used sources.



June 29, 2016

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(date) (signature)