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How does crisis communication contribute to the effectiveness of disaster management?

Lessons from the Tohoku Earthquake 2011 and some strategies to avoid adverse effects during the forecasted Nankai megathrust earthquake in Tosashimizu/Kochi

起きてしまった過去は変えられないが、未来は変えられる

„The past cannot be changed, but the future can be changed."

KOIDE, Hiroaki (2012)

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Introduction: Disaster Potential in Japan

Rin, a six years old girl from Mimase in Kochi-City collects flowers. In the Japanese society the cherry blossom is a popular symbol of momentariness. Rins hometown is a dangerous place and could be affected by momentariness as well, as a mega thrust earthquake is expected to hit the Kochi Prefecture during the next 30 years with a Magnitude of about 8.4 (KOCHI INTERNATIONAL ASSOCIATION, N.D.).

Earthquakes are a popular example for the meaning of risk in Japan. A risk that hits the society in various ways on all kinds of levels. First of all people experience loss. People lose homes. People lose savings. People lose valuable items. People lose loved ones. And people often also lose hope. But besides the populations individuals, the population loses also as a community. They lose infrastructure and probably sometimes also trust in their government, as terrifying experiences often brings up the question *under what circumstances the damage and loss could have been prevented?*.

Questioning situations is what makes humanity unique. We reconsider our actions and arrange us with others. Tool for our coordination is communication, which is in turn foundation for any society. Humans exchange all kinds of information to satisfy their needs. From our first moments of life we communicate. Not even a language is necessary for example for babies to tell their mothers that they are hungry, they just express their needs with crying.

As we grow up we learn words, which then get developed as our mother tongue. Later on some of us even learn different kind of languages. Furthermore humanity did not only develop various languages, but also tools to use them. Besides face to face talking we are now provided with a wide variety of techniques which allows us to communicate in different kind of ways. These communication tools, like for example emailing, enables us to communicate without an actual conversation. It allows us to adjust the specific types of information to a particular situation through an appropriate medium. And even if no tool nor a word is chosen we communicate, because as Paul Watzlawick said *"One cannot not communicate*" (WATZLAWICK, P. ET AL, 1967).

As communication is a general key for a community`s success, it shows of its meaning in extreme situations like for example during a hostage taking. When a person hiding under a table in a bank, threatened by a bandit with a gun, there are different kinds of communication options. Possible would be first of all, a passive reaction with no action, or in contrast screaming as loud as possible for help. Another option would be to send an emergency text message. This would still be communication, however without a sound, what excels this communication tool probably in this situation as it allows an appeal for help with a lower risk of notice compared to a scream and furthermore a bigger scope.

The bank robbery example underlines the meaning of communication in emergency situations. Connected to the topic of natural hazards, this paper is supposed to expose in which way communication in crisis situations affects disaster management, as effective communication can prevent from fatalities and losses.

Foundation of this paper is a fieldtrip by the cooperation of Keio University Japan and the Austrian Technical University of Vienna. The excursion was in January 2019 and its location was Tosashimizu, in the Kochi Prefecture. Experiences during the trip, like the touching interaction with the young girl Rin, inspired to take a closer look to human interactions within disaster management. Connecting the excursions learnings with literature research connects theory and experience of the research field.

General disaster potential in Japan is introducing the topic and is then followed up by the specific danger of earthquakes. An overview of the threefold catastrophe (earthquake, tsunami and nuclear) and the forecasted Nankai earthquake gain insight of the Kochi prefectures threats. Subsequently the emergency preparedness in general and specifically the warning system and evacuation preparations get descripted. After the overview of disaster prevention complexity, an introduction to the topic of crisis communication is given. Focus of the wide theme are the controversial subtopics of tools and statement correctness. To come to the conclusion successful crisis communication is discussed before the final research questions answer and resume.

Specific research question of this paper is *How does crisis communication contribute to the effectiveness of disaster management?* And leads to the lessons from The Tohoku Earthquake 2011 and some strategies to avoid adverse effects during the forecasted Nankai megathrust earthquake in Tosashimizu/Kochi.

Earthquake Risk Japan

Year	Traffic accidents	Traffic deaths [1)]
1970	718,080	16,765
1980	476,677	8,760
1990	643,097	11,227
2000	931,950	9,073
2010	725,924	4,948
2015	536,899	4,117
2016	499,201	3,904

1) Death within 24 hours of the accident.
Source: National Police Agency.

Table 1 Traffic Accidents and Casualties (Statistics Bureau Ministry of Internal Affairs and Communications Japan, 2018)

Risk is always subjective. *"Acceptable risk is a risk exposure that is deemed acceptable to an individual, organization, community or nation. Acceptable risks are defined in terms of the probability and impact of a particular risk. They serve to set practical targets for risk management and are often more helpful than the ideal that no risk is acceptable. In practice, risk often can't be reduced to zero due to factors such as cost and secondary risk."* (SPACEEY, J., 2017)

In which way can earthquake risk in Japan be seen as an acceptable risk? In 2015 and 2016 around 4000 people in Japan died per year because of traffic accidents (Table 1). The Tohoku Earthquake from 2011 caused by contrast around 19.000 deaths (Table 2). Both numbers are high and already a single death means condolement for relatives and loved ones. A closer look to the history of these two causes of death might give a little hope for the future. Table 1 and Table 2 display a decrease of deaths for yearly traffic causalities in Japan and deaths of Sanriku area major tsunamis since 1896. While reasons for tsunami casualties are greatly more complex and situational, the clear increase of traffic accidents is caused by new traffic safety policies (IMAMURA F AND ANAWAT S., 2012).

Date	Name	Magnitude	Damage
9 Jul 869	Jogan tsunami	8.3-8.6	More than 1,000 deaths
2 Dec 1611	Keicho Sanriku	8.1	More than 5,000 deaths
15 Jun 1896	Meiji Sanriku	8.5	21,959 deaths and > 10,000 houses destroyed
3 Mar 1933	Showa Sanriku	8.1	3,064 deaths and 1,810 houses destroyed
11 Mar 2011	Heisei Tohoku	9.0	19,295 deaths and 359,073 houses destroyed

Table 2 Historical and major tsunamis in the Sanriku area and theri resulting damage (Imamura and Anawat, 2012)

Another well-known earthquake is the *Great Hanshin earthquake*, also called *Kobe earthquake* from 1995. The earthquakes magnitude of 6.9 was below the earthquakes mentioned above (ISC, 2015). This event took around 6000 peoples life (USGS, 2009).

There are several policies to decrease death numbers of natural disasters in Japan. This paper clarifies the influences of communication in disaster risk management.

The *Japan Meteorological Agency* (JMA in the following) published various tables to show how various seismic intensities effect humans and objects during their appear. For people who never experienced earthquakes Table 3 is a very picturesque description and gives an idea of the multiplicity of seismicity and allows an understanding what the risk about an earthquake is. It mentions the variations of humans general shaking realization, levels of fear and the plurality of impacts to their body functions, like for example sleep, standing or walking. With a seismic intensity above 6 there is a possibility of people thrown through the air. While these body wise circumstances can already make it difficult to evacuate in earthquake situations, peoples surroundings affect their security additionally. Objects from all levels can get detached and endanger humans or animals. Inside lamps might swing heavily against heads or things or windows which could crack. Other objects like vases might fall down from above, bigger things like TVs can drop down from their stands, or even whole furniture can fall over. Outside electric wires can be an indicator for even little seismic activity, at a intensity of lower five also their poles start moving, windows can break and even roads might get damaged. An intensity from upper 6 possibly even derails concrete walls. (JMA, 2018)

Seismic intensity	Human perception and reaction	Indoor situation	Outdoor situation
0	Imperceptible to people, but recorded by seismometers.	-	-
1	Felt slightly by some people keeping quiet in buildings.	-	-
2	Felt by many people keeping quiet in buildings. Some people may be awoken.	Hanging objects such as lamps swing slightly.	-
3	Felt by most people in buildings. Felt by some people walking. Many people are awoken.	Dishes in cupboards may rattle.	Electric wires swing slightly.
4	Most people are startled. Felt by most people walking. Most people are awoken.	Hanging objects such as lamps swing significantly, and dishes in cupboards rattle. Unstable ornaments may fall.	Electric wires swing significantly. Those driving vehicles may notice the tremor.
5 Lower	Many people are frightened and feel the need to hold onto something stable.	Hanging objects such as lamps swing violently. Dishes in cupboards and items on bookshelves may fall. Many unstable ornaments fall. Unsecured furniture may move, and unstable furniture may topple over.	In some cases, windows may break and fall. People notice electricity poles moving. Roads may sustain damage.
5 Upper	Many people find it hard to move; walking is difficult without holding onto something stable.	Dishes in cupboards and items on bookshelves are more likely to fall. TVs may fall from their stands, and unsecured furniture may topple over.	Windows may break and fall, unreinforced concrete-block walls may collapse, poorly installed vending machines may topple over, automobiles may stop due to

			the difficulty of continued movement.
6 Lower	It is difficult to remain standing.	Many unsecured furniture moves and may topple over. Doors may become wedged shut.	Wall tiles and windows may sustain damage and fall.
6 Upper	It is impossible to remain standing or move without crawling. People may be thrown through the air.	Most unsecured furniture moves, and is more likely to topple over.	Wall tiles and windows are more likely to break and fall. Most unreinforced concrete-block walls collapse.
7		Most unsecured furniture moves and topples over, or may even be thrown through the air.	Wall tiles and windows are even more likely to break and fall. Reinforced concrete-block walls may collapse.

Table 3 Human perception and reaction, indoor and outdoor situation (JMA, 2018)

Tohoku Earthquake

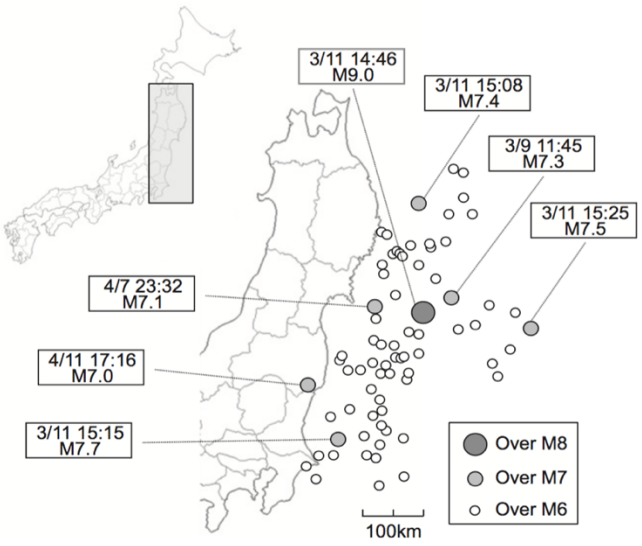

Figure 1 March 11. 2011 Tohoku Area earthquakes, JMA 2011

On March 11. 2011 at 14:46 JST an earthquake hit Japan with a moment magnitude of 9.0. This was Japans most powerful earthquake since beginning of measurements. The epicenter was 130km of the Oshika Peninsula at a depth of 24km. A decisive factor for the dimension of the disaster was its time scale of about three minutes. As Figure 1 displays, there were besides the main earthquake many fore- and aftershocks with Magnitudes of 6 and higher. (IMAMURA F. AND ANAWAT S., 2012)

In result there were tsunami warnings for the entire east coast of Japan, as shown in the Map in Figure 2. Up until the very north of Hokkaido people resaved warnings for evacuation. Warnings became reality and at 15:36 JST. At this time a tsunami hit the Japanese east coast. At around 300km the triggered wave reached with over 20m. At the city of Miyako the maximum hight of the tsunami reached even higher with the immense extent of 39m. The caused disaster was overwhelming. 62 Cities were heavily damaged and about 500 km2 inundated. The situation in the prefecture of Miyagi was especially dramatic, as over 300km2 of its land was flooded. (VOGT, H. 2013)

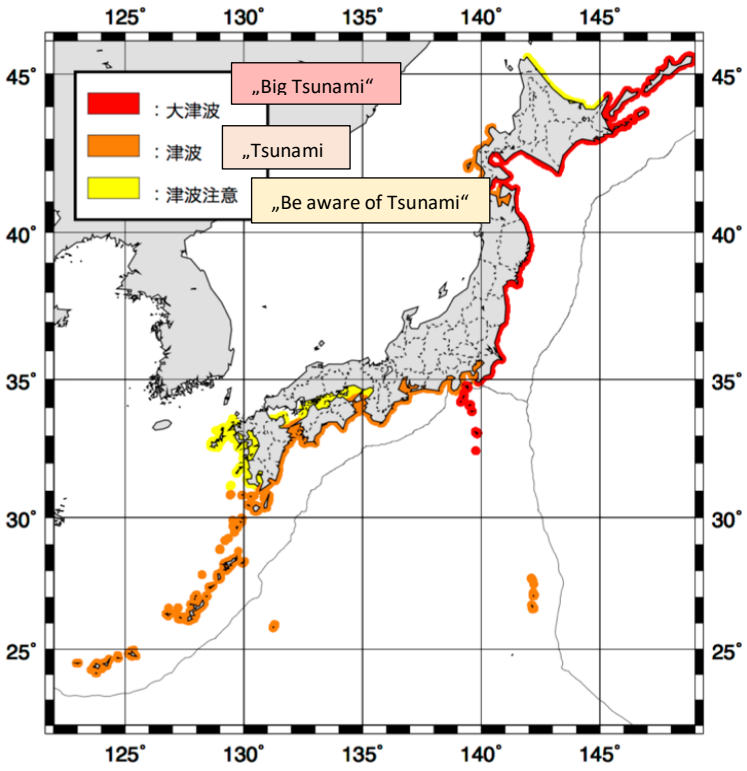

Figure 2: Tsunami warnings, March 11. 2011, JMA 2011

The disasters consequences hit the nation on different levels. Besides the immense inundations, there were over 19000 causalities, damaged private and public buildings and issues with all kinds of hard and soft infrastructure. (IMAMURA F. AND ANAWAT S., 2012)

Part of the damaged infrastructure was the water and power supply. For instance 216 000 households in the prefecture of Miyagi were not supplied with water and electricity.

The lack of water and power supply has also consequences for all kinds of industries as their various chains got interrupted. This caused not only production pauses, but also impossibility of necessaries against damage like cooling of machines. One component part of the power supply was the nuclear power station *Fukushima Daiichi*. Although the facility itself produces energy, a lot of power is needed to run and control the system. Tragically the precautionary measures were not enough to secure the system over the tsunami. Figure 3 shows the structure of the facility. The plants six reactors are divided into two blocks, one with reactor five and six, and one with reactor one to four. As the location is directly at the sea, there is a protective wall with a hight of 5,7m. The protection wall was not enough – the tsunami reached the facility with a hight of 13m. Already the earthquake had consequences for the power plant, as the facility was impacted by a power breakdown. Part of the disaster prevention are diesel auxiliary power units, which came now to action to supply the reactors with energy for the very important cooling system. While the emergency power supplies for the reactors five and six worked, the ones for the other for reactors didn't – because they got

Figure 3 Reactors of the nuclear power plant Fukushima Daiichi, Tepco, 2013

completely flushed away from the tsunami. Another emergency power supply were batteries, located in the basement, unfortunately also their operation wasn't possible as the batteries became functionless as the buildings got flooded. With the lack of energy supply the cooling of the reactors was not possible anymore. At 16:45 JST the governmental and local authorities got informed, about the cooling breakdown in reactor one and two, which caused around two hours afterwards the declare of nuclear state of emergency for the very first time in Japan. Thereupon the citizen close by the reactor were called for evacuation and shortly after the evacuation area got expended. (VOGT, H. 2013)

Many after-effects of this disaster reveal economically. Besides the immense damage through the nuclear disaster, fishing villages were one of the most impacted cases. Their geographical location allowed them the practices they did often since many generations. However in the same time it hazards them to lose everything at once. The ocean - the fisher families source and danger of life. At the coast of the Miyagi prefecture 142 ports and nearly 10 000 fishing vessels got destroyed. (VOGT, H. 2013)

In addition the tourism sector was heavily affected. Not only the prefectures which were hit, but also Japan as a country, as the nuclear situation insecured people worldwide.

Consequently there were not only immense expenses due to the disaster, but for the same reasons also less income.

The Tohoku-regions reconstruction and recovery became a priority for government after the disaster. In reason of heavily damaged transportation infrastructure, the rescue and emergency care possibilities were limited. For the needed supply specific key parts got prioritized in the reconstruction plan. Main roads and the rail network had dignity and connected to the medical supply 90% of the hospitals got quickly enabled to operative readiness. The reconstruction and recovery achievements differed however from place to place. Besides the financial aspect, the redevelopment process is exacerbated by regulations and policies. The intense changes of places in a physical and organizational way demand adjustments to the situation. For some places a reconstruction is so questionable, that relocation seem to be a better solution, despite the variety of difficulties, starting already with a location finding. (VOGT, H. 2013)

Nankai Earthquake

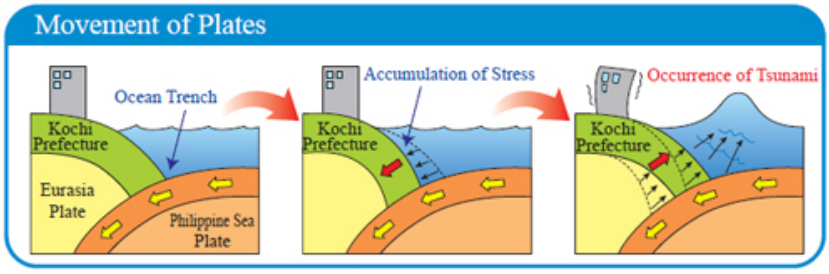

Figure 4 Movement of Plates, Kochi International Association, (n.d.)

Due to the movements of the Eurasian and Philippine tectonic plates at the ocean trench of Shikoku island, earthquakes emerge. As the Philippine plate shifts itself underneath the Eurasian plate immense physical stress accrues and grows over time until it reaches a peak and repulse back. This backward motion is an earthquake. As displayed in Figure 4, this impulse is extremely powerful and implicates with its energy a tsunami with the overlying mass of water. (KOCHI INTERNATIONAL ASSOCIATION, N.D.)

Observation and historical documents prove, that this specific seismological process, called *Nankai Trough Earthquake*, is recurring in periods of 100-150 years. Last occurrence of a Nankai Earthquake was in December 1946. The magnitude of 8.0 conducted tremors from the epicenter 50km off the coast to Shikoku. Although the earthquake and its following tsunami generated around 700 deaths and about 5000 building collapses or rip offs, the event of 1946 is considered to be relatively small. In consequence remaining stress is assumed at the ocean trench, which is expected to cause the next Nankai megathrust earthquake earlier than usual. Figure 5 shows how the expected magnitude of 8.4 will quake the different areas of the Kochi prefecture. The model displays the spatial distribution of the preestimated seismic intensity. With a decrease of closeness to the ocean, there is mainly also a decrease of power of the tremors. However the physical basis determines the local impacts. While in the interior area primarily tremors of seismic intensity from strong 5 up to weak 6 are predicted, places in the coastal area are expected to get hit by intensities in the upper 6 up to a strength of 7. Additionally to the seismic intensity comes the long estimated continuance of 100 seconds. Aside from the fact, that the earthquake will in all probability rise a destructive tsunami, it may also occur landslides and land subsidence. (KOCHI INTERNATIONAL ASSOCIATION, N.D.) Projecting scenarios with models like the example of Figure 5, is an important technical achievement for disaster management. On one hand it allows better spatial planning and on the other hand it enables damage prediction.

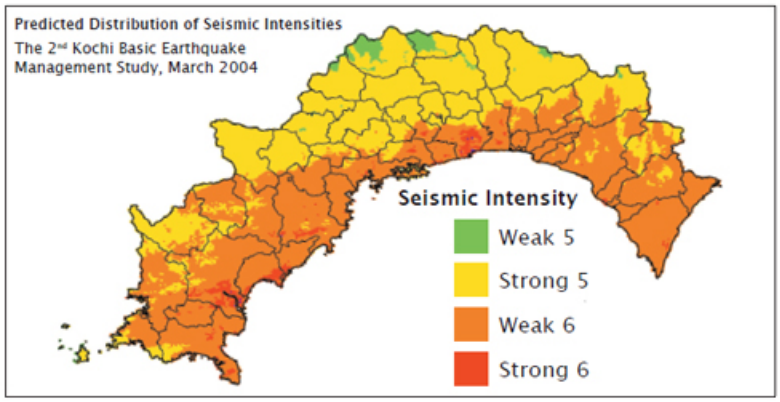

Figure 5 Seismic Intensity of expexted Nankai Earthquake in Kochi prefecture, Kochi International Association (n.d.)

Emergency preparedness of local citizens

For disaster preventions it is important to have specific local and regional impacts in mind. Disaster prevention measures at homes of Japanese induvials` are widespread. Fixture of furniture and other items is as important as emergency kits with food, a medical grab bag, sanitary products and money. Besides prepared items it is also important to have the individual mental preparedness in mind. This can be achieved by education for reality awareness and evacuation drills. A survey of awareness and activities related to disaster management from 2016 exposed, that only 34% of the Japanese make the preparations that can be made in daily life although realizing that disaster preparedness is important and only 3% make sufficient preparations as a priority matter. Going back to the issue of depopulation, the survey indicated as well, that older people tend more to prepare compared to younger Japanese. (CABINET OFFICE JAPAN, 2017: 62)The government of Japan has a widespread grid for public support for emergency situations. Their actions cover not only hard infrastructure issues like for example generating and maintenance of embankments, but also measures of soft infrastructure as conducting drills. In case of emergency the state facilitates affected regions with supplies, extra officials and financial support. However the governments facilities do not cover the publics needs at all, as a study about the disaster of Great Hanshin-Awaji Earthquake evidenced. It published with Figure 6, that 34.9% of buried or confined humans got out on one`s own and 60% got rescued by Family, neighbors or friends. Only 1.7% of the victims was salvaged by rescue units. These numbers prove the importance of self-help and mutual support during rescue operations. (CABINET OFFICE JAPAN, 2017: 61)

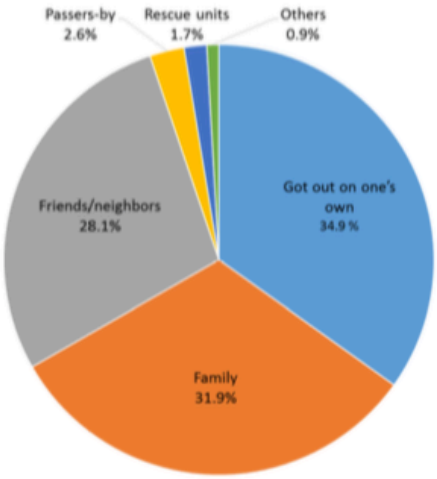

Figure 6 Types of Rescues, Cabinet Office Japan, 2017

The society on its own represents itself as the resource social capital, which is needed for evacuation in disaster situations.

In general Japan is dealing with different kinds of issues because of its depopulation. Regarding the importance of self-help and mutual support during disaster situations, the depopulation is possibly furthermore aggravating the struggles rescue operations.

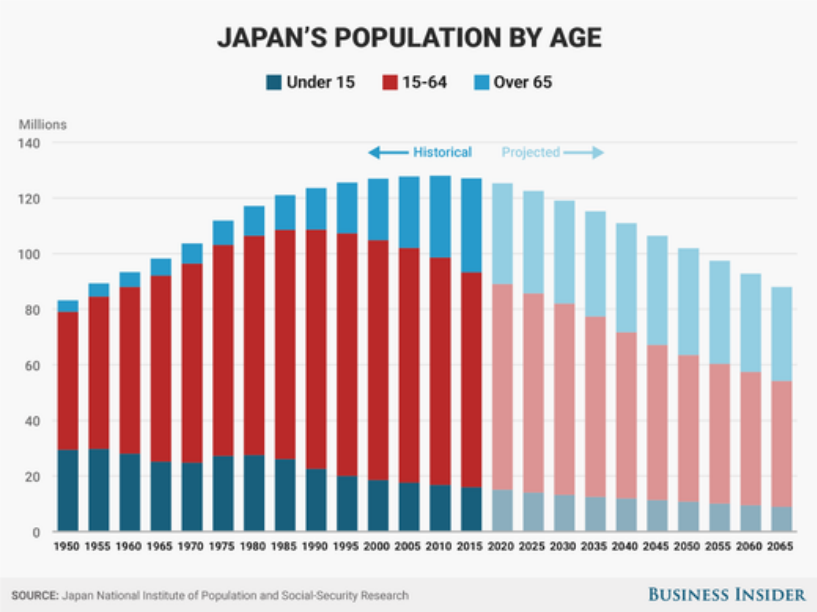

Figure 7 Japans`s population by age, Jayant Bhandari 2017

As shown in the graphs on the left (Figure 7), the amount of people over 65 years is rising more and more compared to the younger population. Facing serious rescue operations the lack of naturally more vital people could harm the success of mutual support. As the Cabinet Office Japan published also the numbers of volunteers in disaster management organizations and fire corps are shrinking. The Japanese government strengthens therefore public initiatives in several ways. People need to be aware that they are actually exposed to danger themselves, but unfortunately many believe that destiny will chose others. (CABINET OFFICE JAPAN, 2017: 61)

As the rescue numbers of Figure 6 show, locals themselves are have value as individuals and with their union as corporative initiatives they create an increase of everyones value. Unions enable bonding and bridging between each other and with other unions. Feelings of solidarity establishes and the community's network grows. The term social vulnerability describes a communities resilience by external triggered issues like natural disasters or disease outbreaks (ATSDR AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY, N.D.).

Communities solidarity is very complex and depends on various factors. The differences between individual communities is in the following described by the example of two communities of Tosashimizu municipalities. In general residents of Tosashimizu are known for their strong bonds. It is common to know each other in the neighborhoods and many people live in the area since a long time already. The two communities of districts in Tosashimizu were analysed in a previous study. Per Census 2004 one of the communities had 97 residents and the other 357. Both districts have similar initial situations with a coastal-mountainious location, populated by over one-third aged people (over 65 years) and a rural status. A flood disaster in 2001 affected both areas, so that a disaster management comparison was taken. The analysis of Mimaki and Shaw indicates the factors for improvement of cooperation between communities and government. Training programs or similar tools for community leaders are needed to raise their awareness of estimated damage and the importance of its daily

communal communication. Also identifying influences of community network development, for example regarding their communication and decision making process achievements, or relating support for (sub)leaders and resident groups. Once the factors are identified communities should make use of the acquisition of knowledge to increase the networks performance inside the community and outbonding to contact points. This framework is a general base and needs to be adjusted for every single individual community as their physical and human geographical initial situations are enormous diverse.. (MIMAKI J. AND SHAW R., 2007)

To summarize the set out above, the following description from Imamura and Anawat pairs the complexity of approaches and their connectivity: *„In order to save lives from tsunamis, identifying vulnerable groups and area should lead to practical and effect evacuation plans including the routes for the shelters and safety place. Interdisciplinary science integrating health science, human-behavior science, social science, civil engineering, architecture and urban planning is required to support the planning at each area."* (IMAMURA F. AND ANAWAT S., 2012, P. 30)

Warning System

Japan is worldwide one of the countries with the highest frequency of earthquakes. The current state of technology helps to forecast earthquakes and tsunamis. Although the number of deaths was high, the warning system did save many lives during the Tohoku disaster 2011. (VOGT, H. 2013)

On the basis of the Kumamoto earthquake sequence the performance evaluation of the current early warning system for earthquakes and the next-generation methods in Japan was evaluated. The system is operated by the JMA since 2007 and this performance evaluation took place in April 2016. With the system strong motions of seismic activity get issued, depending on the motions extent as information or warnings. During the evaluation the system did not have dropouts or crucial underestimations, only some over estimations occurred. Results of the evaluation are impressive. Reasons for the overestimations seem to be short distances between small earthquakes, as they cause complications for the separation of trigger data. Besides the current system also the new Integrated Particle Filter (IPF in the following) and Propagation of Local Undamped Motion (PLUM in the following) methods got observed. With a particle filer the IPF method obtains seismic source elements. The PLUM method allows a pre-estimation of seismic intensity by observation of intensity even with unknown hypocenter. Their implementation is expected to be a further success for the current warning systems performance and thereby general disaster management. (KODERA ET AL., 2016)

In the case of the Tohoku Earthquake 2011, the warning system issued an alarm 8 seconds after the detection of a first P-wave and the tsunami warning three minutes after the earthquake. (IMAMURA F. AND ANAWAT S., 2012)

Early warnings are an immense success for disaster management, however the technical warning itself is not enough, determining is the warnings spread – what traces back to the topic of communication.

Evacuation

As soon as the warning got received every second counts. This is a key moment to bring proof to the previous preventive measurements. People have to find their way to the evacuation point. Do they know the route from the drills? How simple is it physically manageable to reach the evacuation point? Are current conditions similar to the conditions of the drills, or do people maybe get surprised by the difference of darkness or cold or wet weather conditions? These questions explain the diversity of possible surprising difficulties for peoples escape to the evacuation location and should be communicated during the drills.

Figure 8: Evacuation Route 1, Nakahra, own figure, 2019

Depending on the individual situations and equipment of devices, tsunami warnings reach people by different sources. Sirens are supposed to be a communication tool to reach a whole municipalities at once. In context of Japans aging population it is however questionable if all residents are physically able to hear the warnings, or if in reason of deafness the message might get lost. The populations aging reduces in addition the potential exploitation of personal technical devices like smartphones, which could also be used as a first level emergency communication tool for evacuation warnings. And surely also in following second level crisis communication the lack of its usage is restricting the processes.

The municipality of Nakahra in Tosashimizu is an example for good evacuation planning, as their self-protection citizen group got awarded for their preventive measurements. Part of their disaster prevention is a municipal plan of Tosashimizu and a detailed emergency plan for Nakahara. The self-protection group of Nakahara has a devoted leader. Every step after an emergency is in principle predefined and annually trained once or up to three times. Who will warn whom in the case of an event. What emergency actions are prioritized. Emergency packages with medications of individuals are getting prepared in advance, due to the local aged society this is however a very difficult task, as many medications are needed for the elderlies. Evacuation locations should be up to date with alimentation, water and blankets, here too the average age makes things more difficult and complex. Additionally the evacuation routes should be predefined for individual citizens and known from drills. Independent of difficult weather or lightening circumstances the route needs to be easily walkable. There are big gaps of evacuation route conditions. Not only differs one way from another, but rather one routes condition changes on its course. Pictures of an evacuation route in Nakahra show the wide range of route conditions. Figure 8 shows stairs with a handrail, it is the beginning of the evacuation route. The next picture (Figure 9) exposes, that a good condition of a path is however not necessarily always given, as the picture displays the other end of the staircase, which is actually barely a staircase-shaped anymore and involves the danger of slipping due to its shape. On the further way the evacuation route continues as a beaten track. The lack of handrails

Figure 9: Evacuation Route 2, Nakahara, own figure, 2019

Figure 10: Abandoned House, Nakahra, own figure, 2019

might be problematic for the elderlies – who are not to forget the majority of the affected people. In addition with the uneven surface the evacuation route endangers tumbles for people who hasten to escape from a tsunami. Besides route conditions the surroundings have danger potential as well. Such could be untended forest or abandoned houses, like the example of Nakahara in Figure 10 shows. Cause of abandoned houses is often death of people without descendants, or with descendants living far away. The costs to remove such houses is often too high for municipals to pay for it.

Figure 11: Natural evacuation places, Mimase, Kochi City, own figure, 2019

Independent of the routes condition, many of the elderlies are not able to evacuate themselves. The Nakahara self-protection citizen group found a solution for them: a subleader system. Several people are responsible for residents in need for help. In case of emergencies these subleaders pick up the ones in need of help.

Places of evacuation are diverse. In general they can be structured into natural and manmade evacuation places. An example for a natural evacuation location is a mountain like shown in Figure 11 and an evacuation tower manmade as Figure 12.

Figure 12: Evacuation Tower, Kochi Prefecture, own figure, 2019

Most important feature of the natural evacuation example of Mimase municipality (Figure 11) is its shape and height as a mountain. An additional feature of the location is its forest vegetation. The forests maintenance reflects the level of disaster risk preparedness in Mimase. A local disaster risk protection emergency group protects at the same time the forests as they prepare to protect themselves. Hinders by uncontrolled wild growth of shrubs and trees on the evacuation routes are eliminated and biomass is harvested. The well-kept forests indicates that landscape management and maintaining the ecological functions of the

forest are still high on the agenda. On the highest point of Mimase forest is an evacuation shelter. It is supposed to be filled with emergency packages for everyone, however Figure 13 shows a picture of the shelter in 2019 being nearly empty. Many things are planned, but not everything is already implemented. The question is if enough will be implemented once the expected disaster occurs. Private owners of the forest are happy that the local group is maintaining their forest as well. By using private forest plots the evacuation routes can be minimized and save places can be reached earlier than otherwise possible.

Figure 13: Evacuation Shelter, Mimase, own figure, 2019

Once a disaster is happening and escaped people arrive at the evacuation locations the situation might be overwhelming – depending on the disaster situation and the individuals nature. People around might be unable to cope with the extreme situation and cry, shout or express their emotions in other difficult ways. Others might be injured and in worst case scenarios people might see other humans dying right in front of them. Disasters bring out extreme situations loaded with emotions which are difficult to handle. Its effective social intercourse requires communication – crisis communication.

Crisis Communication

Societies are a complex of various interests. In crisis situations are mediated and unmediated involved parties. Primarily there are citizens and the government. But more precisely there are deaths and their bereaved, casualties, NGOs, insurance companies, suppliers, customers, authorities, attorneys, media, employees, competitors, business partners and many more. In sum there are winners and losers. Regardless of their varieties they have one thing in common: all of them communicate. (DITGES ET AL., 2008)

Everyone communicates, in everyday life as well as in extreme situations as in disasters. However, crisis communication does not only cover the communication once a crisis or

disaster is happening. The following citation gives a precise definition or crisis communication and its complexity:

„Crisis communication can be defined broadly as the collection, processing, and dissemination of information required to address a crisis situation. In pre-crisis, crisis communication revolves around collecting information about crisis risks, making decisions about how to manage potential crises, and training people who will be involved in the crisis management process. The training includes crisis team members, crisis spokespersons, and any individuals who will help with the response. Crisis communication includes the collection and processing of information for crisis team decision making along with the creation and dissemination of crisis messages to people outside of the team (the traditional definition of crisis communication). Post-crisis involves dissecting the crisis management effort, communicating necessary changes to individuals, and providing follow-up crisis messages as needed." (COOMBS, W. T. AND HOLLADAY, S. J., 2010, P. 20)

One could differ between first level emergency communication and second level crisis communication. First level emergency communication can be about bringing people from more dangerous to less dangerous places for example and second level crisis communication could be for instance communication with insurance companies, suppliers, customers, authorities, attorneys, media, employees, competitors, business partners and many more to reestablish normal life.

Key aspect of crisis communication is the question of what information is given to the public. Inconsiderated information release may occur bad effects on the disaster management in its entirety. (COOMBS, W. T. AND HOLLADAY, S. J., 2010)

Communication Tools

With a previous study about the usage of new media to communicate technical details during a crisis Coombs and Holladay declared, that people are looking for objective information as well as for emotional support. As an important source for emotional support resulted blogs, where a similar affected individuals share their stories. However over half of the testees time was spend with occupying about information. People did not only look for new information, but also shared their knowledge with others. (COOMBS, W. T. AND HOLLADAY, S. J., 2010) This does not only accentuate humans desire for information, but also their importance of interchange within communities with cooperativeness as a tool to progress. However it also points out the danger of inconsidered information release. Once a statement was made, the message may spread to unintended receivers. Furthermore the spread through public endangers the statements correctness, as the information might be changed over the forwarding.

Not only an information wording influences the message of the receiver, also the sound or font and size of letters in written forms. Capital letters for example can reveal strong negative feelings. (COOMBS, W. T. AND HOLLADAY, S. J., 2010) In verbal information transactions the pitch

of voice and the emphasis on words can be used as a tool to downplay or aggravate the information. According to this the utilization of sound and look of the information can subjective its meaning.

It would be revealing to have evidence of peoples concrete information source in specific moments of the ongoing crisis. Their seek of updates and statements may depend on the crisis` progression. The studies case of Coombs and Holladay revealed anyhow an overflow of some sources at pivotal moments. As contact points were not prepared for the high demand, people's desire of information was not satisfied. (COOMBS, W. T. AND HOLLADAY, S. J., 2010)

Statement Correctness

Harmony is in general very important in the Japanese society. It is common to speak in indirectly with each other to preserve the unity. This indirect way of speaking is known as *high-context-communication*, as every message is coined with a high context and is supposed to be understood within its context by the information's receiver. The term of high-context-communication is popular within the Japanese society, however it is described by *reading the air*. Another concept of communication in Japan is *tatemae,* the public opinion, and *honne*, the private opinion. For Japanese it is taken for granted, that *tatemae* is used for example at work. It implements that statement is what is expected of the information sender, but not necessarily his true opinion. Realistic conversations get compound by this concept. Japanese communication expert Parissa Haghirian advises to ask many indirect questions to reach to the senders true opinion. (HAGHIRIAN, P., 2010)

These customs make communication very complex in general and has potential to aggravate information exchange especially in context of emergencies. Especially information exchange with foreign communication partners are fraught by this, as the involved people might not be aware of the others communication culture.

An example of unapproved comments from the disaster 2011, was a statement addressed to the public using the word *meltdown* for the first time during the disaster operation. The speaker worked with his unauthoritised wording against the government's aim to avoid panic. Uncalmness arised and the demand of more detailed information increased. Once the speaker retracked his statement the media followed up and the term *meltdown* disappeared in newspapers. The given statement was not approved, but it was the first glimpse to the public of actual happenings behind the scenes. Further disclosure of the current conditions was prevented with the displacement of the speaker. (VOGT, H. 2013)

It is questionable what gives the impulse for incorrect and incomplete statements in crisis communication. During the first five days of the nuclear disaster there were no precise and reliable information for the public. Comparing the statements about safety and the actual occurrences at the nuclear power plant, it implies that there was a justification of information divorcement. (VOGT, H. 2013)

Figure 14: Tokyo Police department mascot, Reddit, 2019

Coming back to typical Japanese customs, the word *kawaii* should be mentioned. The words meaning is cute, but in Japan it is not just a word, there is actually a so called *kawaii-culture*. It stands for the representation of all kind of things in a cute way. A popular example is food in shape of an animal, or mascots like the one of the police department of Tokyo displayed in

Figure 14. What is uncommon in western countries is completely normal in Japan. The cute representation of serious things doesn't seem to have limits. Not only police gets a cute symbol, also natural hazards like tsunamis get visualized as cute characters as shown in the example of the warning board at a beach near Tosashimizu (Figure 15) .

Figure 15: Tsunami warning at Tosa Seinan Daikibo Park at a beach close to Tosashimizu, own figure, 2019

Connected to the correctness of statements is also the up-to-dateness of information. Figure 15 does not only contain a questionable symbol. Its written message is an example of measurement network failure. The text warns about the tsunami potential and instructs in case of emergency to evacuate to the mountains. Failure here, is the info boards location, as it is just about 50 meters away from a evacuation building. Why should people run to the further mountains in their very limited time, if there is the upgraded city library as an evacuation site? Is the building not enough for the forecasted tsunami? Is it just for policy? Or is it simply an inattention of the info boards providers to mention the close evacuation site? For certain there is accumulated demand in the connection of the multiple measurements.

Conflict of Interests

The citizens should be every governments priority. In Japan the hierarchy of people is considered as very important. Haak and Haak described operating conditions in Japanese companies with the following quote: *"…above everything a paternalistic leadership is guarding, trusting on unconditional allegiance and fealty of their employees"* (HAAK, R. AND HAAK U. R., 2007, P. 15)

What is expected in everyday life is also effecting extreme situations like in 2011. With the nuclear power plants provider *Tepco* an example of power and situation control is given. The information dependence of all disaster involved parties showed up.

While the official reason of the governments concealment is the avoidance of public panic, additionally another possible reason could be the fear of their crisis managements criticism. *Tepco* was the governments only information resource, confessing this dependence could have suspected the government's power in general. (VOGT, H. 2013)

Every actor within a nation is connected to the government. Figure 16 lines out the key communicators and the two communication levels within emergency and crisis context. Companies, Institutions, citizens and foreign countries are not necessarily connected with each other, however are all linked to the government. This points out the role the government is supposed to play within the actors hierarchy.

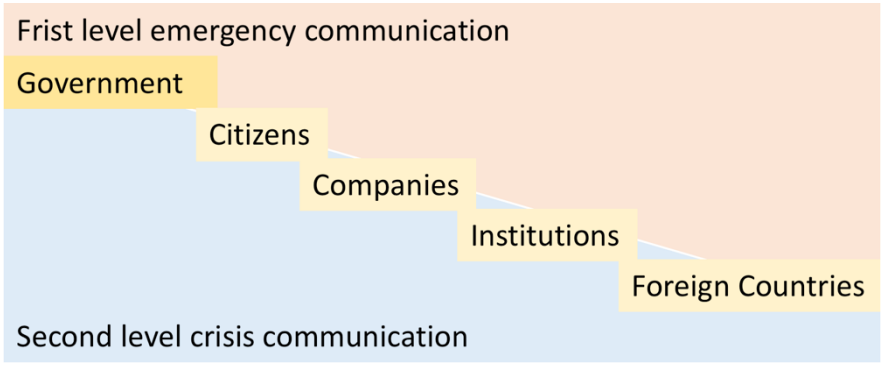

Figure 16: Key Communicators and communication levels, own figure, 2019

However the *Tepco* example above indicated, that the power of the government is not always given. The public's safety should not only be the governments priority. It should also be companies and foreign countries priority. Nevertheless, it is questionable if it is everyone's priority. To provide the public safety, the government should be known as the key power of the system and coordinate a cooperating network of all involved parties.

Successful Crisis Communication

In theory responsible authorities should react openly, fast and with comprehensible explanations. (COOMBS, W. T. AND HOLLADAY, S. J., 2010)

There are four steps necessary for an effective and goal oriented internal communication: information gathering, sighting, coordination and transfer. The report paths and report chains are experientially the first weak spots. Often there are already problems at the source of the scoop's quality. Whether crisis potential in its expected scale is realized, depends on the "sensors" qualification at the incident's location. Afterwards, it is crucial how sensitive the "evaluation authority" is with the perception of the escalation. (DITGES ET ALL., 2008)

This coordination-aspect crucial to maintain the trustworthiness of all parties and their corporation. Content differences of involved parties could confuse the public and lead to mistrust. Even sincere parties possibly get affected by others mistakes. Multiorganizational

corporation is very complex, however the multitude levels can union their resources to get prepared for worst case scenarios.

For success within all levels of crisis communication the dosage of given information is determining. The so called *golden mean* is need to be found to provide enough, but not too much input for the public. Residents should be aware, however also not exaggerated anxious about natural hazards. Yu Muroga, is experienced with exaggeration and understatements of natural hazard awareness communication. The medical salesman grew up in the inland of Japan, far away from the sea. Dangers of tsunamis were not deeply communicated within his community. Later on in his life, Yu Muroga moved to the cost and thereby closer to the dangers he was not aware of. In an interview for the documentary *Japan's Tsunami Caught On Camera* he said that he received warnings of his navigation system, as he was in the car during the earthquake. However Mr. Muroga said he did not have the needed common sense to realize the emergency, because of the lack of experience of him and his raising community. Notwithstanding he also mentioned others people normal behavior around him, who are likely mainly locals. Consequently their communities are experienced with the danger of tsunamis, however these people had a lack of common sense for the danger as well. (PREZ, T. 2011)

Conclusions

Lessons from the Tohoku Earthquake 2011 are that all economic sectors, but especially the fishing and tourism sector got long-dated affected. Additionally the extent of the triggered nuclear crisis is even after years in financial, health wise and ecologic uncertain. The fields and dimensions in the post disaster are as complex as the disaster prevention, but notwithstanding the intricacies have one thing in common: communication. Therefore should all involved parties of disaster management seek for strategies of disaster communication. To avoid adverse effects an elaborated, planned and trained crisis communication on and between all levels is needed as it is the bonding of all solution findings of disaster management.

Communication itself has many compounds which endanger mistakes by unconsidered utilization. The example of Mr. Muroga pointed out the difficulties of communicating the right amount of warnings. An exaggerated imaging of the situation could for instance lead to underestimation in later following emergency situations. Downplaying the dangers however, might lose the trust of the involved parties. This trust is supposed to be taken care of, because when people lose everything they have due to natural disasters they should at least have a responsible government to cover their back.

Today's technical communication tools offer a wide range of options to meet everyone's demands, however the tools also need to be known and served. Preventive measures should include the tools awareness of all concerned parties and provide a plan of usage in emergency situations. Considering this, a deeper understanding of peoples information demand is

needed to allow an effective planning of communication operations to facilitate everyone's needs.

In addition to the process of communicating with each other, the communication of information in terms of sources and their connection should be kept in mind too. To value the potential of all single preventive foundations they need to be attuned with each other. Any updates of informing prevention like info boards should be included in processes of physical measures like re- or new construction of evacuation sights. Likewise should a network ensure to link scientific approaches directly to key actors of all fields of crisis management, like for example evacuation drill instructors.

Disaster situations are loaded by time pressure, danger and emotions, therefore it is time to work on a multilevel communication system, because *"after the crisis is before the crisis"* (STEINBACH, A. UND STEINBERG P., 2010).

Attachments

List of sources

Introduction Line

起きてしまった過去は変えられないが、未来は変えられる

KOIDE, HIROAKI (2012): ZUKAI GENPATSU NO USO (THE LIES OF NUCLEAR POWER PLANTS), P.118.

Literature

ATSDR AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY, (N.D.): CDC'S SOCIAL VULNERABILITY INDEX (SVI). HTTPS://SVI.CDC.GOV (ACCESSED 30.03.2019)

COOMBS, W. T. AND HOLLADAY, S. J. (2010): THE HANDBOOK OF CRISIS COMMUNICATION. HANDBOOKS IN COMMUNICATION AND MEDIA. - U.K.

DITGES, FLORIAN; HÖBEL, PETER; HOFMANN, THORSTEN (2008): KRISENKOMMUNIKATION. KONSTANZ: UVK-VERL.-GES..

HAAK, R. UND HAAK U.R. (2007): ARBEITSWELTEN IN JAPAN: WERTE IM WANDEL, STRUKTUREN IM UMBRUCH - ROUTLEDGE, NEW YORK.

HAGHIRIAN, P. (2010): UNDERSTANDING JAPANESE MANAGEMENT PRACTICES, INTERNATINAL BUSINESS COLLECTION. - ROUTLEDGE, NEW YORK.

IMAMURA F. AND ANAWAT S., 2012: DAMAGE DUE TO THE 2011 TOHOKU EARTHQUAKE TSUNAMI AND ITS LESSONS FOR FUTURE MITIGATION. – TOHOKU UNIVERSITY, SENDAI.

ISC (2015): ISC-GEM GLOBAL INSTRUMENTAL EARTHQUAKE CATALOGUE (1900-2009). INTERNATIONAL SEISMOLOGICAL CENTRE.

JMA, 2018: TABLES EXPLAINING THE JMA SEISMIC INTENSITY SCALE. HTTPS://WWW.JMA.GO.JP/JMA/EN/ACTIVITIES/INTTABLE.PDF (ACCESSED 30.03.2019)

KOCHI INTERNATIONAL ASSOCIATION (N.D.): AN INFORMATION BOOKLET FOR THE INTERNATIONAL COMMUNITY IN KOCHI – PREPARING FOR NANKAI EARTHQUAKE. HTTP://WWW.KOCHI-KIA.OR.JP/EARTHQUAKE/ENGLISH/?SS=005 (ACCESSED 2019/03/12)

KODERA ET AL. (2016): EARTHQUAKE EARLY WARNING FOR THE 2016 KUMAMOTO EARTHQUAKE: PERFORMANCE EVALUATION OF THE CURRENT SYSTEM AND THE NEXT-GENERATION METHODS OF THE JAPAN METEOROLOGICAL AGENCY. - EARTH, PLANETS AND SPACE.

MIMAKI J. AND SHAW R. (2007): ENHANCEMEMENT OF DISASTER PREPAREDNESS WITH SOCIAL CAPITAL AND COMMUNITY CAPACITY: A PERSPECTIVE FROM A COMPARATIVE CASE STUDY OF RURAL COMMUNITIES IN KOCHI, JAPAN. – GRADUATE SCHOOL OF GLOBAL ENVIREMENTAL STUDIES, KYOTO UNIVERSITY.

STATISTICS BUREAU (2018): STATISTICAL HANDBOOK OF JAPAN, MINISTRY OF INTERNAL AFFAIRS AND COMMUNICATIONS JAPAN. HTTPS://WWW.STAT.GO.JP/ENGLISH/DATA/HANDBOOK/PDF/2018ALL.PDF#PAGE=23. (ACCESSED 2019/03/12)

STEINBACH, ARMIN; STEINBERG, PHILIPP(2010): NACH DER KRISE IST VOR DER KRISE: HABEN WIR DIE RICHTIGEN LEHREN GEZOGEN UND WAS BLEIBT ZU TUN? - MARBURG: METROPOLIS.

SPACEEY, J. (2017): RISK MANAGEMENT. 4 EXAMPLES OF ACCEPTABLE RISK. https://simplicable.com/new/acceptable-risk (ACCESSED 10.04.2019)

USGS (2009): PAGER-CAT EARTHQUAKE CATALOG, VERSION 2008_06.1. UNITED STATES GEOLOGICAL SURVEY.

VOGT, H. (2013): DIE KRISENKOMMUNIKATION IM FALL DES AKW-UNGLÜCKS FUKUSHIMA DAIICHI - ANALYSE AUSGEWÄHLTER PRESSEKONFERENZEN ZWISCHEN DEM 11. UND DEM 15. MÄRZ 2011. MASTERARBEIT. – KONSTANZ.

PARK, J.-O. AND KODAIRA, S. (2012): SEISMIC REFLECTION AND BATHYMETRIC EVIDENCES FOR THE NANKAI EARTHQUAKE RUPTURE ACROSS A STABLE SEGMENT-BOUNDARY. – JAPAN.

PUTNAM R., LEONARDI R., NANETTI, R. (1993): MAKING DEMOCRACY WORK: CIVIC TRADITIONS IN MODERN ITALY. PRINCETON UNIVERSITY PRESS: PRINCETON; 163–185

WATZLAWICK, P. ET AL, (1967): PRAGMATICS OF HUMAN COMMUNICATION. NEW YORK W. W. NORTON 1967. P. 5 - ONE CANNOT NOT COMMUNICATE

Documentaries

PREZ, T. (2011): JAPANS TSUNAMI CAUGHT ON CAMERA. https://www.youtube.com/watch?v=oArd_9uZOnE&t=2518s (ACCESSED 12.04.2019)

Tables

Graphics