Emergency Information: Does it work?

A qualitative research on the system, organisation, and effectiveness of the German emergency information app NINA

Author: **Tarek Gethe**

Student number: **s1798286**

First supervisor: **Dr. Jan M. Gutteling**

Second supervisor: **Dr. Ir. Peter W. de Vries**

Faculty of Behavioural and Management Sciences (BMS)

Department of Psychology of Conflict, Risk and Safety (PCRS)

University of Twente

Enschede, June 2019

ABSTRACT

In a day and age of rapidly evolving communication technologies, means for emergency and disaster communication cannot be disregarded. The research objectives of this qualitative study are to identify the role that the app NINA embodies among public warning systems within Germany and the European context, to what extent its contents represent expertise from psychological frameworks and empirical studies, and how effective of a warning tool the administrators and users perceive NINA to be. This report answers three research questions: (1) Which underlying psychological concepts and mechanisms have been considered in the development of NINA and how are they integrated?; (2) How does the functionality of the application NINA compare and contrast to the system of NL-Alert as used in the Netherlands?; and (3) To what extent do the app administrators and help organisations deem the application NINA an effective tool to promote risk preventing behaviour among citizens in Germany? Purposive sampling was used to select all participants. Semi-structured telephone interviews have been conducted with a representative of the German Federal Office of Civil Protection and Disaster Assistance with regard to the app NINA, a representative of the Dutch Ministry of Justice and Security on behalf of NL-Alert, and a group of users (n = 6) of the app. Coding was used to identify prominent topics and answers provided by respondents. The results showed that indicators of the mechanisms and concepts of self-efficacy, response efficacy, and risk perception are embedded within the system of NINA. Additionally, advantages and disadvantages of NINA in comparison and contrast to NL-Alert have been described. Lastly, users as well as administrators of the app NINA deem it a useful means for its purpose but also express the need for improvements and enhancements in order to make it a successful future tool.

1 INTRODUCTION

In the case of an emergency, which is defined as ”an unforeseen combination of circumstances or the resulting state that calls for immediate action” (Merriam-Webster, 2019), in relation to a hazard, threat, or imminent danger, it is of high relevance that people in the respective region are promptly informed and accurately advised on how to act. Television and radio broadcast and civil defence sirens are common means for making citizens aware of an emergency (Gutteling et al., 2015). Although these mechanisms seem to have been sufficient to an extent, applicabilities of modern technology are becoming more versatile and it is time to take a closer look at these new means.

In the case of an emergency, which is considered to require public awareness, channels to adequately inform citizens about what happened and how they are to act, in order to protect themselves and others, are changing over time. Although, in Germany, conventional media such as television and radio have not lost in popularity over the last decades (ARD, 2018 and Statista, 2018), these broadcasting devices are often not mobile and, therefore, mainly used at home. On the other hand, smartphones are experiencing a consistent increase in usage among the German public. Whereas roughly six million Germans owned such a mobile device in 2009, that number ascended to 57 million users by 2018 (Statista, 2018). The idea seems obvious as to making use of smartphones for informing citizens about emergency incidences of local or national relevance.

An example of such a public warning system tailored to smartphones is the German emergency information application NINA, released by the German Federal Office of Civil Protection and Disaster Assistance in 2015 (BBK, 2019). The aim of this qualitative report is to evaluate the system, organisation, and effectiveness NINA, using information provided by users of the app and administrators of NINA and the Dutch system NL-Alert. This report seeks to answer the general research question: Is the app NINA a tool that – according to its system, organisation, and effectiveness compared to other such systems – can be a successful means of alerting citizens in case of emergencies in Germany?

1.1 Introducing a reverse 1-1-2 system in the European Union

Requests about the introduction of an EU-wide system for authorities to inform citizens about potential hazards and emergencies (*reverse 1-1-2*, named after the EU-wide emergency number *112*) became more apparent during the last two years. On August 31st 2017, a compromise amendment was released by the Committee for Industry, Research, & Energy in the European Parliament, stating

> ”Member States shall ensure, through the use of electronic communications networks and services, the establishment of national efficient 'Reverse-112' communication system for

> warning and alerting citizens, in case of imminent or developing natural and/or man-made major emergencies and disasters, taking into account existing national and regional systems and without hindering privacy and data protection rules (Charanzová, 2017)".

On November 14th 2018, the European Parliament in Strasbourg accepted the amendment – it has, nonetheless not yet been approved by the EU Council, as of the time of composing this study (CTIF, 2018). After its approval, all EU states have to implement a national system as described above within three and a half years (Katwala, 2018).

1.2 First European initiation of a cell broadcast emergency system in The Netherlands

In November of the year 2012, the *Ministerie van Justitie en Veiligheid* (Dutch Ministry of Justice and Security) introduced NL-Alert, which is a warning system designed to alarm citizens locally or nationally in the case of imminent emergency or a high risk of danger (Gutteling et al., 2014). Before its launch, the Dutch government relied solely on the use of sirens, television, and radio broadcast for spreading information about the direct vicinity of an impending disaster. What makes NL-Alert superior to the former means of alarming is the ability to reach the vast majority of the population in a very short time, due to a cellular broadcast system targeting all active mobile phones in the regarding region. Furthermore, it not only makes it apparent that there is an emergency (the sole purpose of a siren) but it also informs the message receiver about what the emergency is and how he or she is required to act. The service is anonymous, as there is no registration or authentication required in order to receive the notifications. No application has to be installed, no internet connection is required, and the system is insensitive to congestions of public telephone connections. One condition for its functioning is that the mobile device is to be logged in to a cell within the country (Gutteling et al., 2014). As seen in Figure 1, NL-Alert makes use of test alarms for users to check whether their mobile phone is adjusted properly to receive NL-Alert notifications. Some mobile phones, such as the Apple iPhone, allow for the user to switch off the reception of official emergency notifications. (Ministerie van Justitie en Veiligheid, 2018). In Figure 2, an example of how an NL-Alert message generally appears on the phones of citizens receiving it, can be seen. Commonly, emergency information via these messages is displayed in the following order: "*NL-Alert*", *date* and *time*, *type of hazard*, *location affected*, *instructions on how to act* (Veiligheidsregio Groningen, 2018).

In December of 2018, the above-mentioned ministry released a press report about the system's usage, stating that roughly eleven million (74 per cent) citizens in the Netherlands, 12 years of age and older, received the biannual test notification of NL-Alert. Compared to the previous test in June of the same year, the number of alert receivers had increased from, back then, ten million citizens (67 per cent) (Ministerie van Justitie en Veiligheid, 2018). As of today, the Netherlands are, aside

Figure 1. NL-Alert message that notifies the user that their telephone is adjusted correctly for receiving NL-Alert messages. Taken from: ICulture. (2016). Controlebericht NL Alert. Retrieved April 30, 2019, from https://www.iculture.nl/nieuws/nl-alert-controlebericht-6-juni-2016/

Figure 2. NL-Alert message about a fire with smoke development, providing citizens with advice on how to act, sent out by the Safety Region Groningen. Taken from: Veiligheidsregio Groningen. (2018). NL-Alert. Retrieved April 30, 2019, from https://www.veiligheidsregiogroningen.nl/wat_jij_kan_doen/voor_een_crisis/nl-alert/

from Lithuania, the only European country with a system of that kind (Gutteling et al., 2017). NL-Alert notifications are sent out by region, via *veiligheidsregios* (Safety Regions), depending on the location and scale of the regarding incident. These Safety Regions are means initiated by the Dutch government to ensure adequate protection of citizens against any kinds of risks or imminent dangers, by dividing the country into 25 sectors that all use a standardised method of organisation (Ministerie van Veiligheid en Justitie, 2013).

1.3 "Notfall-Informations- und Nachrichten-App" (NINA) in Germany

In 2015, the *Bundesamt für Bevölkerungsschutz und Katastrophenhilfe* (BBK, Federal Office of Civil Protection and Disaster Assistance) launched the first version of the *Notfall-Informations- und Nachrichten-App* (Emergency Information and Broadcast App), officially abbreviated NINA. On the 5th of June 2015, the app was made available on the iPhone App Store (Apple Inc., 2015).

The emergency information app NINA is targeted at citizens in Germany and provides alert information from the civil protection and disaster assistance department to members of the public in cases of imminent hazard or a threat of such. Examples of situations like these can be the spread of hazardous substances or a conflagration near populated areas. Also weather-related warnings – such as storms, floods, or black ice – are part of the app's alert coverage. The user is given the option to preset regions within Germany (as shown below in Figure 3) and to allow the app to identify the location of the user's phone. In this way, emergency messages will only be presented when the given incident is occurring in at least one of these regions relevant to the individual (Bundesamt für Bevölkerungsschutz und Katastrophenhilfe, 2019).

In such a case, the user will receive a push notification with a dedicated signal tone on their phone. This message will include a brief description of the hazard and the regarding region. When the user taps on the notification and thus opens the app, thorough information regarding the type of

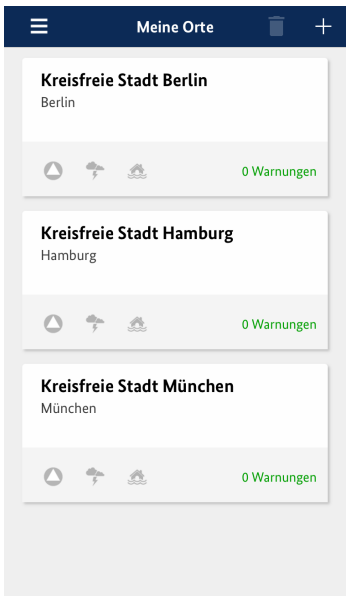

Figure 3. Home screen of NINA, displaying the locations preset by the user. Green indicators refer to no emergencies.

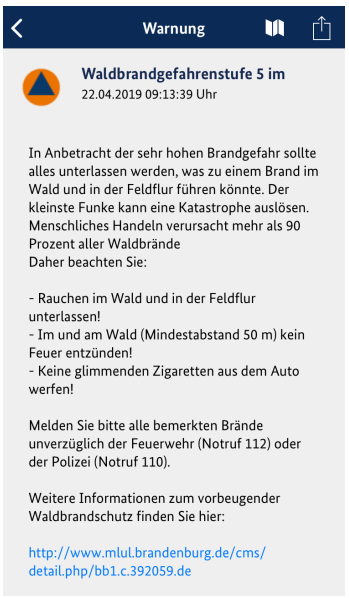

Figure 4. Example of a description of a high risk of forest fires, displayed after opening the message about an emergency.

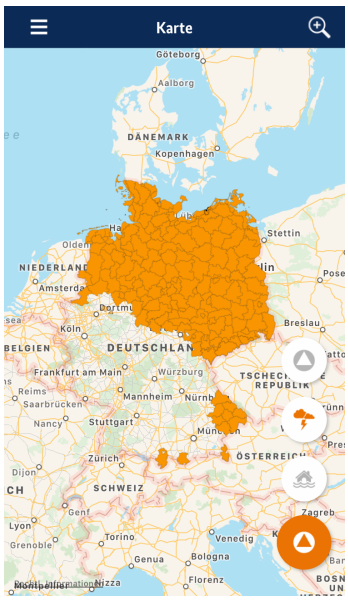

Figure 5. Map view of NINA, displaying a risk of storms in northern Germany. Hazard regions are marked orange.

incident, the level of danger, the estimated duration of the hazardous situation, and instructions on how to act will be presented. Furthermore, the user is provided with detailed instructions and manuals for how to be prepared for hazardous incidents of various kinds and how to act in different situations of imminent danger, within the NINA app. An example of this can be seen in Figure 4, which presents a detailed description of an emergency situation – in this case, an imminently high risk of forest fires within the region relevant for the user. Another example can be viewed in Figure 5, which shows the map view within the app. In this example, the hazardous regions are marked with orange colour, as well as the corresponding icon. Three icons on the bottom right of the screen allow the user to switch between displaying hazards about general civil protection (top icon), weather hazards (middle icon), and flood hazards (bottom icon).

1.4 Psychological concepts and mechanisms in the context of risk research

Self-efficacy. This mechanism is defined as the ”beliefs in one’s capabilities to organise and execute the courses of action required to produce given attainments” (Bandura, 1997). In other words, it resembles the question of whether a person deems themselves able to perform a task or a set of actions in order to achieve a certain result. When related to the topic of emergency information, the individual’s level of self-efficacy would determine how likely someone is to gather information by installing and using a smartphone app such as NINA. Rimal and Real (2003) provide evidence that a certain level of risk-efficacy (and response efficacy) is required for an individual to engage in self-protective behaviour. Therefore, this mechanism is essential to consider since an app such as NINA allows for the collection of information needed to act in a self-protective manner.

Response efficacy. This mechanism refers to whether the advice that one gets to deal with the threat is useful in the sense that it will successfully help one to cope with the threat (Kievik & Gutteling, 2011). The level of response efficacy would then influence to what extent the individual feels that the information provided via NINA prepares them appropriately for making the right decisions in the case of an emergency. The relevance of this concept in relation to emergency communication can, as well, be explained by the findings of Rimal and Real (2003), which suggest that, in order for an individual to engage in self-protective behaviour, there need to be certain levels of response efficacy (and self-efficacy). This information can lead to the assumption that, only if citizens have certain levels of self-efficacy and response efficacy, they are likely to take actions by, for example, downloading an application such as NINA to collect information on how to appropriately prepare for potential risks. Therefore, this mechanism is important to consider in this research.

Risk perception. Commonly, this is defined as ”an individual's subjective assessment of certain characteristics of a risk, such as the severity of the risk in terms of negative consequences, the probability of occurrence of these consequences, and the individual's personal vulnerability” (Slovic, 2000). This concept is very closely related to the field of emergency communication and sometimes termed *risk awareness*. In earlier studies, this mechanism was examined in further detail and a close look was taken at determinants like the individual's knowledge of the subject matter and the level of trust in others as adequate risk managers (Möller, Hansson, & Holmberg, 2017). These determinants line up well with a system like NINA as citizens have a personal interest in being adequately informed about a relevant emergency incident for the sake of their own well-being and, therefore, are expected to trust the respective authorities as risk managers. In the current context of emergency information transmission, risk perception is a highly relevant concept. A study published in the Natural Hazards journal found that ”higher levels of induced risk perception and efficacy beliefs result in significantly higher levels of both information seeking and the intention to engage in self-protective behaviour than lower levels” (Kievik & Gutteling, 2011). Therefore, it can be argued that citizens, who use a means such as the app NINA to actively inform themselves about risks affecting them, are more likely to act in accordance with protecting themselves against such risks. Combining all three concepts, Smith, Ferrara, and Witte (2007) found that ”the combination of elevated levels of risk perception, self-efficacy, and response efficacy would motivate people to adopt self-protective measures”. Therefore, including these concepts in this study appears to be of high importance.

1.5 Previous findings in emergency communication research

In 2018, van Dijl and colleagues carried out an experiment on the ”integration of social media features into a cell phone alert system for emergency situations”, in which the effect on self-efficacy, risk perception, and reported information sufficiency were studied when functions of social networking sites are added to a system like NL-Alert. The level of information sufficiency was

reported to be significantly higher, while the levels of self-efficacy and risk perception remained unchanged (Van Dijl, Zebel, & Gutteling, 2018).

Gutteling, Kerstholt, and Terpstra (2017) performed a study on ”citizens’ adaptive or avoiding behavioural response to an emergency message on their mobile phone”. This paper concerns the behavioural effects that NL-Alert has on people in the Netherlands – specifically, which mechanisms determine whether citizens become more or less likely to react to a threat shown via NL-Alert. The study concluded that individuals tended to demonstrate adaptive behaviour towards the emergency messages when a high level of emotions was shown, when individuals perceived social pressure to act, and when the quality of the emergency message was perceived as higher. Therefore, emotions and the individual’s social environment were found to be more influential predictors of adaptive behaviour than cognitive factors (Gutteling, Kerstholt, & Terpstra, 2017).

In 2017, Reuter, Kaufhold, Leopold, and Knipp conducted a ”multi-method study on distribution, use, and public views on crisis apps” in Germany and Europe. Specifically, within Germany, the focus of this study was on the apps KatWarn and NINA. The researchers have evaluated survey responses from 1369 participants in Germany, which demonstrated that, of all participants, 79 per cent have never downloaded any kind of crisis communication app, 5 per cent didn’t know, and only 16 per cent stated to have done so. Similar results were indicated by the same survey sent to 1034 participants across 30 European countries with 77 per cent, 7 per cent, and 16 per cent, respectively. Most participants of the study explained that they have not been affected by any kind of natural disaster yet and estimate the likelihood of this happening to be low. It was concluded that the motivation of citizens to download a crisis communication app was weak, due to a general perception that natural disasters are supposedly unlikely to occur. It should be noted that participants were only asked about their perception of natural disasters, therefore not addressing emergencies of human origin, such as house fires with severe smoke development or leakages of hazardous chemicals (Reuter, Kaufhold, Leopold, & Knipp, 2017).

An essay composed by Bean and colleagues in 2015 describes in detail the five information components which a public warning message needs to contain in order to increase the probability that the notification is going to be comprehended appropriately. These are namely *hazard* (the kind and severity of the danger), *location* (where it occurred and which regions are affected), *guidance* (how citizens are advised to act), *time* (when it happened and, if determinable, how long the hazard is likely to last), and *source* (where the information is coming from). Additionally, such messages should be consistently formatted and formulated so that, in the event of messages being sent frequently, citizens are habituated to the message style and pick up the relevant details efficiently. The authors emphasise that it is highly relevant that the information is accurate, unambiguous, and detailed. This also includes informative details such as the consequences of action or inaction, in order to increase the level of risk perception and thus motivate those affected to act appropriately and immediately. Public warning messages that are vaguely descriptive and lack informative detail

are therefore said to be potentially misleading and might provoke incorrect decisions of people at risk (Bean, et al., 2015).

In a German paper of 2009, hydrogeologists Bittner, Günther, and Merz address the continually increasing risks of extreme weather conditions in Germany (and other countries), such as storm surges, thunderstorms, hailstorms, avalanches, heatwaves followed by droughts and a growing risk of large-scale forest fires, but also extraterrestrial dangers such as magnetic storms. The authors express their concern that citizens are often not motivated to prepare for the occurrence of such incidences. It is said to be of high relevance that citizens be accurately informed about the risks and appropriate means of preparation, in order to reduce the likelihood of harmful and costly consequences (Bittner, Günther, & Merz, 2009).

1.6 Motivation and research questions

The aim of this qualitative study is to investigate the development process, the administration, and the effectiveness of the smartphone app NINA, designed for both lay citizens and official organisations. For this purpose, three research questions have been formulated:

(1) Which underlying psychological concepts and mechanisms have been considered in the development of NINA and how are they integrated?
(2) How does the functionality of the application NINA compare and contrast to the system of NL-Alert as used in the Netherlands?
(3) To what extent do the app administrators and help organisations deem the application NINA an effective tool to promote risk preventing behaviour among citizens in Germany?

The first question hints at various concepts and mechanisms which have become apparent in earlier psychological research on risk, crisis, and emergency communication and can be used to determine and predict how a group of individuals might react to an incident. This is eminently relevant to identify since a smartphone application such as NINA should perform effectively in fulfilling its purpose. Therefore, basing the functionality on scientific results is meant to increase the likelihood that the app achieves the indented outcome of adequately informing the public at risk.

The motivation behind the second question is to find a possibility for the creators of different systems to learn from each other. As described earlier, the systems of NINA and NL-Alert represent different approaches of informing the citizens about the parameters of an emergency situation and advising them on how to react most appropriately. In order to ensure constant improvement and adequate adaptation, it is relevant to identify what the similarities and differences between two nationally implemented systems are.

The third question serves as an indicator of how successful NINA is as a system, taking into consideration both, the app administrators and the citizens (lay or professional) that make use of it. In order to get a realistic impression, both parties will be given the opportunity to describe their experiences and present a reasoned opinion on how effective of a tool they deem NINA to be.

2 METHODS

2.1 Design & Procedure

In this qualitative study, the relevant data have been collected by means of semi-structured interviews. A representative from the *Bundesamt für Bevölkerungsschutz und Katastrophenhilfe* (BBK, German Federal Office of Civil Protection and Disaster Assistance), who manage the administration of the app NINA, respectively one representative from preselected civil protection and help organisations from Germany, and a representative of the Dutch NL-Alert system have been interviewed by means of semi-structured interview schemes. A uniquely tailored scheme was used for the representative interviewee of the BBK, while the representative interviewees of the civil protection and help organisations were all asked fully standardised questions. Open as well as closed questions have been included in the scheme (See appendix). The questions asked to the interviewee representing the BBK were focussed on the administration and organisation of the app service and the underlying psychological mechanisms which have been considered for the construction of the app NINA. Similar questions were asked to the interviewee representing the NL-Alert system. The other interviewees, who are members of civil protection and help organisations and fire departments, were asked questions regarding their experience with the app NINA – generally, to what extent they deem the app NINA to be an effective tool for informing the public about emergency incidences and for advising them how to act adequately in these scenarios.

The interviews were conducted over the telephone or via a video communication service (Skype or FaceTime), determined according to the preference of the respective interviewee. Before the start of the interview, all interviewees have been informed about the nature of the study and its relevance, how the data is collected and processed, and the interviewee's right to terminate the interview at any time and withdraw their data from the study, without giving reasons. Additionally, the interviewee was asked for their consent to the interview being audio-recorded for the sole purpose of enabling the researcher to transcribe the interview and accurately process all responses. After an interview had commenced, the transcribed responded were sent to the respondent via email, with a request to verify that all answers had been understood and transcribed correctly. If respondents wished to correct an answer, they were given the opportunity to do so. Consequently, all transcriptions have been reviewed and verified by respondents to increase the reliability and validity of the collected

data. With the exception of one interview concerning the NL-Alert system, all interviews have been conducted in the German language for the reason that the app NINA is tailored for German citizens and only information relevant for regions within the sovereign territory of Germany is available via the app. One interview with a representative of a Dutch Ministry of Justice and Security responsible for NL-Alert was conducted in English.

2.2 Materials

A telephone or a computer is used for communicating with the interviewees. Should a computer be used for an interviewee preferring a video call over a regular telephone call, it is ensured to have a stable internet connection available and installed the telecommunications applications Skype 8.41.0.54 (latest version) or FaceTime 5.0 (latest version).

In order to ensure that each interviewee is accurately informed about their rights and the study itself, an informed consent sheet is readily available for the interviewer to read to the interviewee before the start of the interview. If the respondent agrees to the interview being audio-recorded, the multimedia framework QuickTime 10.5 (latest version) will be used to tape the responses. In the case that the interviewee does not consent to interview being audio-recorded, their responses will be documented using a note pad. Additionally, an interview scheme with all questions to be asked has been available to the interviewer. The schemes for the semi-structured interviews conducted can be found in Appendices A through C of this report.

2.3 Participants

Purposive sampling was used for the selection of all participants. The reason for this is expanded on below. This study has been working with two groups of participants: a *user group* and an *administrator group*. Within the first group (app users), respondents qualified for participation by having the app NINA installed on their smartphone and by making use of it in any way. Participants of this group were recruited by contacting help and civil support organisations and fire departments in different cities spread out across Germany. Out of twelve institutions approached, one private help organisation from Bad Nenndorf, one civil protection organisation from Bonn, and four fire departments from Stuttgart, Karlsruhe, Bremen, and Hamburg responded affirmatively to a request for participation in the present study. For reasons of confidentiality, neither the names of the respondents nor the names of the institutions are disclosed in this report. The decision to interview people employed at help and protection organisations and fire departments was made for two reasons: (1) within these jobs, one is familiar with various emergencies and professional communication during risk situations and is therefore estimated to be able to critically observe systems like NINA from a professional standpoint; (2) the likelihood to find respondents who

frequently use the app NINA was estimated to be high within these organisations, for most of them are advertising the usage of this app via their websites. The locations of the chosen organisations are spread out across Germany, in order to achieve results which are not limited to only one region.

The second group (app administrators) consisted of two respondents: respectively one representative of the BBK and of a Dutch Ministry of Justice and Security, partially responsible for the administration of NL-Alert. The first participant of this group, a representative of the BBK, is qualified to answer various questions regarding the construction and administration of the app NINA, for that their work is directly concerned with these responsibilities. The second participant of this group, a representative of the Ministry of Justice and Security in the Netherlands, whose work includes the administration of the NL-Alert system, agreed to answer questions regarding the construction and administration of NL-Alert.

2.4 Semi-structured interviews

The decision to conduct semi-structured interviews was made in order to ensure that all interviews generally follow a standardised scheme. This structure still allowed for the freedom to link questions to responses of the interviewees and to adjust the arrangement of questions, in situations where doing this supports the progression of the interview. For participants of the first group (app users), this was done to create the atmosphere of a natural conversation and motivate the respondents to thoroughly explain their experiences and opinions about the functionality of the app. After all, the goal of the interviews with respondents of the first group was to get detailed insights into the perceived effectiveness and the different ways in which the app NINA is being utilised. All questions asked to the interviewees of the first group are addressing their way of engagement with the application, with the aim of finding out how participants perceived the practicality of NINA. It was intended that respondents make use of this semi-structured setting to speak freely about all encounters with using the app that come to their mind.

The interview scheme contained twelve main questions. Four of these were fully open questions and eight were closed questions, out of which three questions contained an additional open follow-up question. These follow-up questions were for the purpose of asking *why* a response to the previous closed question was given.

For participants of the second group (administrators), the decision to conduct semi-structured interviews was made for reasons similar to the ones explained above, regarding the interviews conducted with the first group. Contrastingly, respondents of the second group were not intended to answer questions referring to their private usage of the app NINA or NL-Alert. Instead, the aim of interviewing respondents of this group was to gain detailed insight into the organisation and administration of these emergency communication services. As each respondent of the second group is professionally engaged with the administration of their respective emergency

communication service, when responding to the interview questions, they were estimated to mention concepts or terms, which the interviewer was not yet familiar with. The nature of a semi-structured interview allowed for the possibility to clarify these concepts, instead of having to obey to a fully structured scheme.

Both interviews, regarding the app NINA and NL-Alert, featured similar questions which were tailored to each system separately. The representative of the BBK, responsible for the app NINA, was asked 15 questions, out of which two were closed questions and 13 were open questions. The representative of the Dutch Ministry of Justice and Security, responsible for NL-Alert, received 14 questions, out of which two were closed and twelve were open questions.

2.5 Data analysis

All interviews have been transcribed, which allowed for them to undergo a coding procedure. The transcription of all answers has been performed to ensure that no information stated by the interviewee is left out. The coding process is done with the aim of identifying the most prominent topics mentioned by the interviewees. This creates the opportunity to create a comprehensible and unambiguous structure of displaying the results, as found below. Looking back to the research questions of the present report, special attention has to be paid to what the responses actually tell us about the effectiveness and usefulness of the app NINA, as perceived by both sides, the administrators and the users. Additionally, it is relevant to investigate how the research-supported psychological mechanisms, such as *self-efficacy*, *response efficacy*, and *risk perception* have been considered in the creation and administration of the app NINA. When comparing the responses received from the administrators of the app NINA with the information gathered in the interview with a representative of a Dutch Ministry of Justice and Security, responsible for NL-Alert, it will be clarified which advantages and limitations both systems have, in which domains they share similarities and in which areas they present a contrast to the other.

After all, the data analysis and interpretation of the results will be future- and improvement-oriented. More specifically, this means that the outcomes and recommendations of this study might demonstrate to be relevant for the administrating parties of NINA, in terms of how the system might be developed or improved in the future. As identified in the background research earlier in this report, it is in the interest of a great number of people to have a fully functioning, accessible, and effective tool that follows the intention of making the lives of citizens in Germany safer.

3 RESULTS

3.1 Psychological concepts and mechanisms within NINA

As previously explained, the underlying concepts and mechanisms which are relevant for this report are self-efficacy, response efficacy, and risk perception. The interview conducted with the German Federal Office of Civil Protection and Disaster Assistance (BBK) provided further insights into how these concepts and mechanisms are incorporated within the app NINA. It can be noted upfront that the collected data indicates the above-mentioned concepts and mechanisms to be present in the overall system of the app NINA. This will be further elaborated below.

3.1.1 Self-efficacy

Two open questions of the interview were directed at identifying to what extent self-efficacy has been considered during the construction and administration of the app NINA. At first, attention was paid to the measures and actions to motivate as many citizens as possible to download and use the app NINA on their smartphones. The respondent explained that the BBK is planning to increase the number of advertisements, targeted at citizens, to promote the app and increase its popularity. Currently, the app has been downloaded 4.2 million times, but it is not certain how many people actually make regular use of it. It is reported that, with an increasing presence of public advertisements, the BBK is receiving regular feedback from users. This demonstrates a growing engagement with citizens who have become aware of the app, use it, and make suggestions for future developments.

Secondly, it was considered whether the increased efforts for advertising are showing the desired effects and whether there are future plans to further enhance the number of users. The interviewee informed that a concept for additional and expanded advertising is being written, as of the time the interview was conducted. Near future intentions are to promote NINA by placing advertisements in public transport vehicles and at bus and train stations, as this is where vast numbers of people are present during their daily commutes. Furthermore, it is proposed that NINA will be advertised on public national television and radio broadcast, prospectively. Moreover, a national warning awareness day has been introduced in 2018, which will, from now on be held annually in September. The intention of this warning awareness day is to create a general public understanding of the topic of warning, risk, and emergency within Germany. The respondent reports that, so far, the quantities of users have been rising with increased public relations work concerning the app NINA.

3.1.2 Response efficacy

Next up, the focus is shifted to the incorporation of the response efficacy concept within the app NINA. Three open questions were formulated to gain further insights on this behalf. The first point of consideration was about the means to make sure that the transmission of information through warning messages functions without misunderstandings. The respondent mentioned that ”misunderstandings can never be completely ruled out”. However, she expressed the importance of staff who work in the NINA administration and in the civil protection control centres being properly trained and acting responsibly, due to the stakes being high in emergency situations. It is of high relevance that people, who issue warning messages through NINA, use language that is comprehensible to every person who should be on the receiving end. The interviewee goes on to say: ”Through public relations, it is tried to draw attention to the topic of warning messages and how to deal with the appropriate content [emergency tips provided within the app] in a preventive, proactive, and reactive manner”. Additionally, she emphasises that employees at the *NINA-Helpdesk* and the numerous civil protection control centres can be contacted for questions and assistance with regard to the app NINA and the warning messages issued through it.

Closely linking to the topic of reducing ambiguities for app users, the next focus of the interview, in terms of response efficacy, was about measures being taken to make citizens feel better prepared and able to react to imminent dangers and catastrophes. In these situations, according to the interviewee, staff who issue warning messages focus on the *Five Ws* (**W**ho is in danger? **W**hat happened? **W**hen did it happen? **W**here did it happen? **W**hy did it happen?) and on clear instructions for how message receivers are supposed to act. Reportedly, it is also made sure that a colleague proofreads the message before submission, in order to secure factual correctness and completeness. As of the time that the interview was conducted, no false alarms occurred in the history of the app NINA.

Lastly, it was addressed whether there are examinations or surveys carried out in order to know in hindsight, whether notifications were understood correctly, or whether citizens acted according to the respective advice. The respondent claimed that ”there is currently no review done by the BBK” on this behalf. The reason provided for this is that the responsibility of issuing warning messages lies with the federal states and cities within Germany and not with the NINA administration of the BBK. Allegedly, such a review does not seem appropriate due to the current federal structures in Germany.

3.1.3 Risk perception

With respect to this last domain, three questions have been devised to address to what extent the principle of risk perception has been incorporated by the creators and administrators of the app NINA. At first, the interviewee was asked about the responsibility of the BBK to build up trust to citizens, so that the contents of the app and the warning messages are being perceived as authentic. The respondent stated, similarly to the previous answer, that ”the warning app NINA is a supplement

to all other warning systems" and should not be relied on solely. She went on to say "if the power fails and wireless networks fail, then NINA can only be used to read the emergency tips", as with no internet connection, warning messages will no longer reach the app users. Coming back to the question, the interviewee mentioned that the BBK sees its responsibility in the domain of educating citizens about the meanings of various warning, sent through different channels, such as the correct interpretation of sirens, which are allegedly being rebuilt in several regions of Germany. The respondent closes her answer by saying "We are on the way to create an overall system and to sensitise the population for the meaning and relevance of emergency information."

Secondly, it was focused on how it is being ensured that citizens are aware of the consequences of various threats which they could potentially be faced with. To visualise this topic, the respondent provided an example of an emergency situation, namely, a fire with heavy smoke development. In such a case, a warning notification is issued through the app NINA to the citizens that are located in the affected area, which describes the scenario and requests people to stay inside and to keep their doors and windows shut. The interviewee went on to say "In addition, we also have emergency tips, where users can also read a lot about dangers and appropriate actions [in response to them]. Experts have really thought about how to best shape this information."

The final question formulated to find out more about underlying psychological concepts and mechanisms included whether the NINA administration receives feedback from app users and to what extent such feedback is taken into consideration. The respondent began by stating "We are really close to the user and get a lot of feedback", then went on to say that the BBK is approached by several users who suggest how the functionality of the app NINA could be improved. Allegedly, many of these suggestions have been considered and implemented. The interviewee provided an example of how the development of NINA continued after its launch in 2015, by explaining:

> "We started, at that time, by sending all warnings for the whole Federal Republic [Germany] to all users. Then, many users came to us and said that they did not want that. Then we changed it so that they [the users] could use their own places and then receive the warnings only for those places – at county level".

Here, the respondent referred to the introduction of the option for users to preset their relevant locations within the app, instead of every citizen receiving all notifications for all of Germany. Further, the interviewee explained that several users requested not only to receive warning messages in the event of large catastrophes but also notifications which inform citizens about impending weather conditions that might pose to be a threat to citizens. As a consequence, the DWD (*Deutscher Wetterdienst*, engl. German Meteorological Service) was integrated into the nationwide MoWaS system. Therefore, users of NINA, nowadays, receive warning notifications about potentially dangerous weather conditions, in addition to all other risk or catastrophe related information. At

last, the interviewee articulated that a number of users reach out to the BBK for help with technical issues related to their smartphones and the functionality of the app NINA. In several cases, users seem not to be aware of how to appropriately adjust the notification settings of their smartphones to be able to receive notifications sent through NINA. In these cases, staff members of the NINA-Helpdesk try to solve individual problems via telephone or email. At the end of her answer, the respondent stated "Then we test why that [the problem] could be. Then we can write a tutorial to help other users with the same problem. And of course, that only works through getting feedback."

3.2 Comparing and contrasting NINA to NL-Alert

Table 1
Comparing and contrasting the two systems NINA and NL-Alert using information collected mainly through semi-structured interviews. Data gathered through literature and online sources is labelled with an asterisk.

Categories	**Warn-App NINA**	**NL-Alert**
Date of Introduction	June 2015 *	November 2012 *
Form	Application to download *	Pre-installed system *
Administration	BBK *	MinJenV *
Article 110 Compatibility	Undetermined	Compatible
Transmission Technology	MoWaS / Internet *	Cellular broadcast *
Potential Reach	4.2 million (~5% of population)	11 million (74% of population) *
Frequency of Use	Undetermined	>50 times per year
Publisher of notifications	Civil protection control centres	Safety Regions *
Distinguishable Signal Tone	Optional	By default, not optional
False Alarms	None recorded	None recorded
Research & Statistics	Have not been conducted yet	National surveys done biannually
Consideration of User Feedback	Yes	Yes
Present and Future Function	Part of a multimodal network	Part of a multimodal network

All information within chapter 3.2 of the current report, if not specified otherwise, stems from the interviews conducted with the representatives of the Federal Office of Civil Protection and Disaster Assistance in Germany (here referred to as Respondent 1) and the Ministry for Justice and Security in the Netherlands (here referred to as Respondent 2).

NINA, as a smartphone application, has been published in June of the year 2015. NL-Alert, on the other hand, was released two and a half years prior to NINA, in November of 2012. As explained earlier in this paper, the app NINA is never pre-installed on any device and has to be actively downloaded by individual users – from the App Store for iOS or the Google Play Store for Android. A functional internet connection is required to receive warning messages through the app NINA.

Contrastingly, NL-Alert originates from a completely different system. As stated by Respondent 2, only a cell tower reception is required and no application has to be downloaded and, in many cases, there is no possibility to opt out of receiving NL-Alert messages. The reception of cellular broadcast messages is possible for all smartphones of established mobile technology manufacturers nowadays. According to Respondent 2, as a result of negotiations with the company Apple, it is no longer possible for users of iPhones to switch off the reception of 'Government Alerts' within the Netherlands, given that the user has updated their phone to a recent version of Apple's mobile operating system iOS. Additionally, a section on the website of the company Apple informs users that "In some countries, you may not be able to disable Government Alerts" (Apple, 2019).

As explained by Respondent 1, the administration of the app NINA is managed by the Federal Office of Civil Protection and Disaster Assistance. The BBK provides access to the German national system MoWaS (*Moduläres Warnsystem*, engl. modular warning system), which is further expanded on in section 3.3.1 of this report. This system allows the civil protection control centres in Germany to broadcast emergency information via the app NINA and other channels, such as television and radio. These control centres have no abilities to administrate the app NINA but have the authorisation to send warning messages to users of NINA for given regions within Germany. This type of hierarchy is similar to the one of NL-Alert. As stated by Respondent 2, the Ministry for Justice and Security holds the responsibility for the system to function without disruptions and is in the possession of a mandate to send out national NL-Alert messages via cellular broadcast to all mobile phones logged in to a cell within the territory of the Netherlands. Nevertheless, the transmission of local NL-Alert messages is in the hands of the 25 Safety Regions within the country. These have the authority to transmit NL-Alert messages to all mobile phones located inside their boundaries and to those inside of neighbouring Safety Regions.

The first two questions of both interviews were based on the EU legislation for the update of Article 110 in the European Electronic Communications Code, which orders all countries in the European Union, within 42 months after its publishing, to have in place a public warning system to reach mobile end devices of concerned citizens. The interviewees were asked whether they, on behalf of the BBK or MinJenV, are aware of the release of Article 110, its binding responsibilities, and whether their regarding system is expected to fall under the conditions demanded within the legislation. The representative of the app NINA responded that she is not aware of this legislation but added that tasks on a policy level are not part of her work-related responsibilities. Respondent 2, on the other hand, explained as follows:

> "[…] But for us it would be very good if other countries implement more or less the same system as we have. And also I think that it's a good development that other countries have a reverse 112 system now. […] The first paragraph of the Article in the European Electronic Communications Code is about cell broadcast and the second paragraph gives the

> opportunity to develop a public warning system that is similarly efficient and effective, compared to cell broadcast and SMS broadcast. NL-Alert falls under the classification explained in Paragraph 1 of Article 110".

Concerning the frequency of warning messages being sent out via the app NINA, Respondent 1 explained that this information is not available. Respondent 2, on behalf of NL-Alert, explained that:

> "In five years [since NL-Alert has been launched in 2012] it has been used about 200 times, that would be 40 per year, on average. But right now, it is being used more often. Right now it is used at least 50 times per year".

This information is very closely related to data about the potential number of citizens that can be reached using both emergency warning systems. Respondent 1 stated that, as of April 2019, about 4.2 million people have downloaded the app NINA from both the Apple App Store and the Google Play Store. This represents about 5 per cent of 83 million citizens who currently reside in Germany (Statistisches Bundesamt, 2018). Allegedly, it is not possible to determine how many people do, in fact, receive warning messages with NINA. According to the website of the MinJenV, a test warning message sent via NL-Alert in 2018 indicated that about 11 million citizens in the Netherlands above the age of twelve were able to receive this message. This is equal to about 74 per cent of the country's population (Ministerie van Justitie en Veiligheid, 2018).

Within the settings menu of the app NINA, the user has the option to select one of several signal tones for warning messages. Additionally, it is possible to select various tones for different kinds of notifications: general civil protection, flood, and weather alerts. The user is also given the opportunity to mute signal tones or to entirely disable alerts for individual warning types. With regard to NL-Alert, this is not possible. Respondent 2 describes that "The alarm tone from NL-Alert is very strong and penetrating and can be easily distinguished from normal message sounds". It is not possible to select a different tone or to adjust the volume of alerts. Both respondents 1 and 2 have reported that no false alarms have commenced in the history of the app NINA or NL-Alert. Respondent 2 added:

> "It has been the occasion that there was some information that was incorrect or not complete, but that's very much depending on what the people in the dispatch room are writing into the message. This could occur on a language level, but also on a technical level, if the person forgets to put a dot in a URL and the link to the website doesn't work anymore".

In terms of taking feedback of citizens into account when it comes to developing and improving the systems of NINA and NL-Alert, both respondents stated that the administrators of both systems closely consider and, where possible, implement suggestions from users that are collected via multiple channels (telephone, email, social media, etc.). When asked about whether the BBK undertakes efforts to conduct research about demographic information of users of NINA or about whether messages are received, understood, and acted upon as intended, Respondent 1 explained that the BBK does not collect this kind of information. As outlined in chapter 3.1.2 of the current report, no reviews of such kind have been executed. With regard to NL-Alert, Respondent 2 asserted that research about the functionality and reception of NL-Alert is composed two times a year:

> ”We are working together with a research company, who call about 2000 people all over the country shortly after the biannual national test message. People are then asked whether they received the message. If that is not the case, then the goal is to try and figure out why”.

With regard to the last question of the interviews – to what extent the interviewees deem the app NINA and NL-Alert suitable to be the future tools of notifying citizens about emergencies both respondents responded similarly, in explaining that each channel is a part in a system of several channels. As explained in further detail in chapter 3.3 of this paper, Respondent 1 expressed that the app NINA will, in the near future, continue to be part of the multimodal warning system supported by MoWaS. She does not exclude the possibility that there might be an implementation of a German cell broadcast system in the coming years, but underlines that the combination of all warning channels has to be perceived as a whole and not as one system standing out more than others. Respondent 2, on the other hand, explained that NL-Alert has the technological potential to serve as an emergency warning system for the entire population of the Netherlands. Additionally, he explains which other warning channels the MinJenV has implemented and which concepts there are to be realised in the near future:

> ”But we also use other channels. For instance, we have just implemented the information panels at public transport stops. Soon, we will also implement a landline system of NL-Alert, which is mainly for people who don’t have a mobile phone. This can be especially relevant for elderly people. The system can be subscribed to and then the person will get a phone call with information about the incident to their landline phone at home. We will soon also implement an app, which is especially focussed on people with disabilities. Users that are visually impaired, can increase the text size or connect the app with a Braille reader”.

Furthermore, Respondent 2 adds:

> ”It will never be the case to reach 100 per cent of all people, in no country in the world. But in these ways, we try to add up all the means in order to get the most effective and efficient system for everyone in the Netherlands”.

3.3 Perceived effectiveness of the app NINA in Germany

This section has been divided into two major sections. The first part represents the perspective of the German Federal Office of Civil Protection and Disaster Assistance (BBK), while the second part sheds light on the experiences and opinions of users, in relation to the app NINA.

3.3.1 Assessment of the app NINA by the BBK

As mentioned previously in this paper, according to the administrative staff of the app NINA, about 4.2 million people have downloaded and installed NINA, as of April 2019. This number is derived from the sum of downloads for both operating systems for which the app is available – iOS and Android. Supposedly, data representing how many people actually use the app is not determinable due to strict user data protection regulations. Within the app, the individual user has the opportunity to allow or deny the administrative staff to make use of the service Google Analytics, which can be applied by the BBK to monitor general usage behaviour of app users and the functionality of the app itself. As it is unclear how many individual users have deactivated this service, a total quantity of active app users cannot be determined. Regarding users who have opted in for Google Analytics to be applied, the BBK has the opportunity to see, which regions and locations in Germany these users have subscribed to. This may provide the administrative staff with a general, but not exactly reliable, overview of the regions that NINA is most prominently used in. Nevertheless, no demographic information is yet available about the users of the app NINA and no surveys or other large-scale research studies have been carried out on behalf of gathering this data.

Additionally, it was thematised whether the BBK themselves deem the app NINA a suitable tool to be used by all citizens in Germany for the purpose of being well informed about risks and emergencies. The respondent stated that all warning systems within Germany are to be understood as a whole. These warning systems include the app NINA, television and radio broadcast, sirens (where still active in Germany), and loudspeaker announcements by police and fire departments. To enhance the functionality of NINA, notifications from two other warning apps, KATWARN (*Katastrophenwarnung*, engl. catastrophe warning) and BIWAPP (*Bürger Info und Warn App*, engl. citizen info and warning app), were included into a shared system in early 2019. This means that no matter which of the three applications is installed, all users will receive the same information within warning notifications. This is enabled by the German system MoWaS (*Moduläres Warnsystem*, engl.

modular warning system), developed by the BBK in 2001, originally as SatWaS (*Satellitengestütztes Warnsystem*, engl. satellite-supported warning system). Via this system, civil protection control centres all over the country (mostly integrated within fire departments) have the ability to send out warning messages through various channels, including NINA, to inform citizens in respective regions about risks and emergencies. Accordingly, the BBK is regularly improving the app NINA in enhancing the ease of use and by improving the quality of emergency push-notifications. These developments are also aimed at motivating more people to download and use the app after they have heard of its existence. Therefore, one could argue that this information is also relevant for identifying how the concept of self-efficacy has been integrated within NINA, thus creating a link to the first part of the results of this report.

3.3.2 Users' experiences with the app NINA

Out of all six users who were being interviewed, three had the app installed for about four years, since its launch in 2015. Two others have been using it for two years and the sixth respondent downloaded NINA just in February of 2019. All interviewees learned about the existence of the app NINA through their work, either within the fire brigade or within their duty in a civil support or help organisation. When asked about how frequently they use the app, all respondents provided eminently similar answers, namely, that the app is only being opened after the reception of a warning message. In these situations, all respondents explained, the notification is being tapped on, which opens the app and allows the user to read more detailed information about the respective incident and recommended actions. Respondent 1 described his way of using the app by stating "I generally use the app very passively. I almost never open it just like that but when I read the push messages in case of an emergency notification", while respondent 6 explained, "I open the app only in case of warning messages to read more detailed information".

Two respondents reported that, within their fire department or help organisation, having the app installed is is entirely optional, while the other four explained that it is recommended but not mandatory. Employers cannot stipulate which applications are to be installed on private devices. Nevertheless, all interviewees claimed that they know of colleagues and even family members who make use of NINA. Additionally, three respondents asserted that the app is thematised 'often' within their work environment, while the other three described the frequency of NINA being mentioned at work, respectively, with 'sometimes', 'rarely', and 'never'. Furthermore, three of the respondents remembered at least one situation in which they had been notified, through the app NINA, about a dangerous situation and claimed to have acted in accordance with the instructions.

Two interviewees describe their general experience with the app as 'very good'. For example, respondent 1 explains "The installation is pretty simple and the app, in principle, does what it's supposed to do. You are well informed about dangers in your environment and the push messages are handy". Three claim their experience to be 'good'. For instance, respondent 2 explains:

> ”It is alright, but unfortunately not all control centres are yet integrated into the system. Thus, not all warnings in Germany are sent via NINA. There are several apps and systems that are not all connected. Thus, NINA unfortunately does not cover everything”.

Respondent 6 describes his general experience with NINA as ‘poor’ and explains his answer as follows:

> ”Often there are questions to the fire department after a dangerous situation and users report that the app did not show a warning message. So it does not work reliably. In addition, there is still a lack of information from the BBK and KATWARN [another private app], which concerns the correct settings of phones. The app NINA unfortunately has no detail accuracy within the map view and in the listing of locations. A reasonable map view is desirable. There is no defined area for danger situations, but only a list of generally affected regions”.

When asked about the perceived suitability of the app NINA for members of help organisations and fire departments in the work context, three of the interviewees stated that it could be useful. Respondent 1 explained his response such that ”The use of additional information is always good. Especially with the fire brigade you can, for example, in the event of a storm, adjust to what else might happen during that shift. For emergency services quite useful”. On the other hand, three of the interviewees replied that the app NINA in such a professional context is not useful, according to their opinion. On this behalf, respondent 5 declared:

> ”I would not say that this makes a lot of sense. Anyway, when you come to duty as a firefighter, you're aware that any sort of thing can happen that day. There are other means of communication tools that are more useful to these people”.

In terms of the perceived usefulness of NINA for all members of the public, all interviewees shared the opinion that the app is indeed useful in the private context. Respondent 1 explains that the app is unobtrusive, the information provided is clear, the messages are customised for each location that has been chosen by the user, and also mentions that the option of subscribing to messages from multiple regions allows the user to be updated about incidences happening in the vicinity of relatives. Respondent 2 also supports this argument and expresses the need for more citizens to become aware of and download the app NINA. He argues that using a cellular broadcast system, as applied in the Netherlands, would allow civil protection control centres to reach a greater number of people and criticises that an app like NINA has to be downloaded before it can actually be effective. Respondent 4 provides a similar answer, by stating ”It makes sense, but only for people who have a smartphone. In my opinion, it is still not suitable for everyone. A large part of the

population does not use the app after all". Moreover, another perspective is introduced by respondent 5, who generally endorses the existence of the app NINA, but also provides criticism and incentive for the BBK and the overall organisation of federal warning systems in Germany to improve and to further educate citizens about the significance of emergency information:

> "In general there is a very inhomogeneous warning system in Germany. The confederation is responsible for civil protection, while the federal states are responsible for catastrophe management. There are also, for the most part, no more warning sirens in Germany. The public must have a general understanding of the meanings of alert systems and all citizens should be aware of how the various warnings are actually to be understood. Every citizen should have the app. Nevertheless, further warning options must be available. It must generally be taught to take the reasons for issuing warnings seriously. I feel that some warnings are seen as a call for gazers, rather than a call to really act in the interests of people's own safety".

As some users articulated that, in their opinion, the app NINA itself or the overall organisation of warning systems within Germany require some degree of change and improvement, with the final question of the interviews conducted with users of the app NINA, respondents were given the opportunity to express their recommendations for conceivable adjustments. As the current paper could potentially be taken into consideration by the BBK, the administrators of NINA, the decision was made to unfold this information at this point in the report.

Respondents 1 and 3 conveyed that they are not aware of any elements that should be changed. In contrast, respondent 2 based his recommendations on experiences from the professional context within a help organisation:

> "I am for an expansion of the system. All control centres should be able to access the system and issue warning messages. If you could integrate all this within NINA, you would only need one app. In addition, I would suggest to include a notification function for first responders. As it is now being tested in Schleswig-Holstein, there is an app (Meine-Stadt-rettet), which can register people with first aid training. These will be notified when needed, if someone needs quick help near them. This works in a similar way to the first-responder principle, except that theoretically every citizen with the necessary qualifications can enrol there without having to be employed in an organisation or the rescue service. So you can increase the likelihood that someone will be helped even faster before the rescue service arrives".

On another behalf, respondent 6 suggested a refinement of the map view within the app. It was being criticised that the display of affected regions on the map lacks detail in its accuracy, as the user is commonly provided with a general view of possibly affected counties instead of precise locations.

4 DISCUSSION

The current study has been carried out in order to investigate the development, administration, and effectiveness of the smartphone app NINA. Through semi-structured interviews, relevant information has been obtained about the concepts and mechanisms that allow the app NINA to function as it does, the comparative and contrastive features of NINA and NL-Alert, and the app's perceived effectiveness and future role in the context of contemporary public warning systems in Germany. This chapter of the current report has been divided into three sections in order to remain a structure coherent to the presentation of the results found above. Each division addresses one of the three research questions which this qualitative study seeks to answer thoroughly.

4.1 Psychological concepts and mechanisms within NINA

The results of the current report show that indicators of the three concepts and mechanisms self-efficacy, response efficacy, and risk perception are found to be integrated within the system and administration of the app NINA. Self-efficacy, as explained by Bandura in 1997, is constructed of "beliefs in one's capabilities to organise and execute the courses of action required to produce given attainments". The main actions that are considered by the BBK, in order to increase citizens' willingness to become informed about possible emergency situations in their proximity and appropriate behaviour in reaction towards these situations, are to actively promote the app NINA by means of advertising and awareness campaigns. These promotions include various strategies, such as advertising on national television and radio, setting up placards in public spaces where a lot of people are located, and introducing a national annual warning awareness day. These measures are not only carried out in order to promote the app NINA but to create a general awareness within the German population about existent risks, potential emergencies, and behaviour with the intention of keeping citizens safe. According to the respondent of the BBK, these measures present to have a positive effect on the number of times that NINA is being downloaded. Therefore, it can be said that such actions have the potential to increase the level of self-efficacy, with regard to the current topic within the population.

The second mechanism that was examined in the context of this research is response efficacy, which refers to whether the advice that an individual gets to deal with the threat is useful in the sense that it will successfully help one to cope with the threat (Kievik & Gutteling, 2011). Here, close

attention is being paid to the process of designing warning messages that are concise, informative and unambiguous to whoever receives them. The dispatchers who send out warning messages through the app NINA are to follow certain guidelines with the intention of formulating short and easy-to-understand phrases. In addition, it was said to be routine for at least one more dispatcher to review and verify a message before it is being published, in order to avoid misinformation and confusion. Furthermore, a help-desk of the BBK is available to answer questions to citizens in case of any obscurities that might occur. As of today, no research has been conducted by the BBK with the purpose to investigate whether people received, understood, and acted upon the NINA warning messages as intended. Although, on a national scale, these types of surveys may be complicated, as explained by the respondent, the research conducted on behalf of NL-Alert demonstrates that this has the potential of being a beneficial tool in developing and improving a system such as NINA. Also, this can be concluded to have the potential to increase the level of response efficacy for app users.

Thirdly, the concept of risk perception has been explored within the context of the app NINA. Risk perception has been defined as ”an individual's subjective assessment of certain characteristics of a risk, such as the severity of the risk in terms of negative consequences, the probability of occurrence of these consequences, and the individual's personal vulnerability” (Slovic, 2000). As one part of the concept of risk perception includes the existence of trust from affected individuals towards a group of risk managers (Möller, Hansson, & Holmberg, 2017), it was investigated to what extent the BBK perceives its responsibilities on this behalf. Based on the explanations provided by the interviewee, some tasks of the BBK are majorly concerned with educating citizens about potential risks that individuals might face, the warning systems in Germany, and how to correctly interpret and act according to those. It is likely that, since the respondent did not base her answer on the topic of trust towards citizens, the BBK is generally perceived as an authentic organisation as part of the German government and does not need to be concerned with a lack of trust from potential users of the app NINA. Closely related to the mechanism of response efficacy, dispatchers of warning messages broadcasted via NINA are to ensure that the information included in the notifications adequately informs citizens about the possible consequences of risk situations. Furthermore, the app itself, aside from the function of receiving warning messages, includes a lot of informative content about potential hazards that individuals might be faced with. Within the app's menu *Notfalltipps* (emergency tipps), users are able to access thorough descriptions and checklists that address multiple occurrences which a citizen may or may not have to deal with at some point in time. Examples of this are a manual of how to act in the occasion of a house fire, in order to get oneself and other out of the danger, or a checklist of items that, according to the BBK, every citizen should have in their home in case of a malfunctioning city power grid that can result in a long-lasting electricity cut. Once the app is has been downloaded, this information is also accessible when offline. Overall, the BBK provides individuals with a lot of detailed information within and outside of the

app NINA which can be used to learn about various risks and adequate actions concerning those. Lastly, employees of the BBK and, specifically, the NINA Helpdesk appears to maintain open means of communication and assistance with users of the app NINA. It can be expected that potential users are more confident to use the app when they are confronted with a high standard of customer service and assistance. In a similar context, this has been demonstrated by a study published within the *Journal of Marketing* in 2005 concerned with customer relationship management, which includes providing information and advice to users or potential users of one's service. According to the researchers, "the use of customer relationship management applications is positively associated with improved customer knowledge and improved customer satisfaction" (Mithas, Krishnan, & Fornell, 2005). As the overall purpose of the app NINA is to make citizens lives more secure by incentivising self-protective behaviour and by providing means for doing so, it is worth to take another look at the relevance of the three concepts and mechanisms described earlier. Smith, Ferrara, and Witte (2007) found that increased levels of self-efficacy, response efficacy, and risk perception lead to an enhanced level of self-protective behaviour. Although, with use of the current information, it cannot be empirically determined to which accuracy the actions performed by the BBK represent the three above-mentioned concepts and mechanisms, it can be argued that there is a noticeable overlap between the BBK's explanations of their tasks and empirical findings findings with regard to self-efficacy, response efficacy, and risk perception. Therefore, it may be an adequate approach of the BBK to continue to pay attention to users' questions, concerns, and also recommendations. The aim of this is to increase the number of citizens who feel able to act in favour of their safety (self-efficacy), who are actually able to engage in learning about preventive and protective behaviour (response efficacy), and who are properly informed and educated about risks (risk perception).

4.2 Comparing and contrasting NINA to NL-Alert

The results have shown that the app NINA and NL-Alert are two systems very different in their concept and functionality. Through the analysis, a number of advantages and disadvantages of NINA towards NL-Alert became apparent. The most prominent of them will be discussed here.

While the app NINA has been introduced in the year of 2015 as the first mobile-end-device warning system in Germany, NL-Alert is already available since 2012. Therefore, one can argue that the Ministry of Justice and Security and the Safety Regions in the Netherlands have two and a half years more of experience with a warning system of such kind. This might not seem long at a first glance. But in the current day and age of rapidly developing technologies, this is a long time that has been used to collect vast amounts of data, experience, and feedback to apply for development and improvement of the system. A structural organisation of Safety Regions within the Netherlands currently allows for departments from different locations to work together. In this way, the biannual survey about the functionality of NL-Alert is being carried out nationwide and individual Safety

Regions cannot only broadcast warning messages to their own regions, but also to neighbouring regions, if the severity of the situation demands that. Another advantage that NL-Alert has in contrast to the app NINA its use of cellular broadcast technology, which allows authorities to alarm three-quarters of the Dutch population in a matter of a few minutes. With a potential reach of only about five percent of the German population, it is difficult to argue that NINA could be called a prominent and fully implemented measure amongst other public warning systems within Germany. Furthermore, since an active internet connection is required to receive warning messages via NINA, citizens outside of their homes, with no WiFi or mobile data available, will not be able to obtain valuable emergency information, even if they might be in the direct vicinity of a danger. This is a clear limitation that should not be overlooked by German authorities, as a recent survey of 23086 respondents in Germany in 2018 demonstrated that an estimated 47.5 million out of 83 million German citizens have a telecommunication contract, which does not necessarily include the availability of mobile internet (Statista, 2018). This goes hand in hand with the individual's threshold of actively having to download a smartphone application. It is likely that the app NINA is known by a greater number of people than the number of times it actually has been installed. This poses a problem to overcome when there is an intention by German authorities to be able to adequately inform as many citizens as possible, when a situation demands it.

On the contrary, the app NINA also has a number of advantages. A major asset is the information density that comes with a mobile application. Users have the ability to not only read the one message that has shown up on their screen, but can open the app to get access to thoroughly composed and relevant data, such as a graphical representation of regions affected by danger within the map view. Moreover, users of the app NINA are not limited to the reception of information concerning only their current location. What became apparent during interviews with app users is that NINA can be used to monitor potentially dangerous situations in the regions where family members live. This can be a valuable benefit for users whose parents, to name an example, do not own a smartphone. Another advantage is the possibility to consume some information within the app even without an internet connection. As previously mentioned, the *Notfalltipps* (emergency tipps), composed of information texts and checklists, can be consulted even in the situation of an electricity cut in combination with a malfunctioning telecommunications network. A third advantage is the customisability of the app. Users have the option to adjust distinct signal tones for different types of alarms and can even turn off certain warning types if they are undesired, as was explained by one user of NINA who stated to have disabled all weather-related alerts for personal convenience. On the one hand, it can be argued that these customisation features make NINA less safe and effective. A softer signal tone might be overheard more easily than the rather penetrative tone of NL-Alert and disabled alarms might cause a user to miss relevant information about in incident an their proximity. On the other hand, some users seem to appreciate these types of adjustments, as it gives them a

certain level of freedom. It might be the case that fewer people would be using NINA if these settings were not optional. Of course, this cannot be determined with certainty.

4.3 Perceived effectiveness of the app NINA in Germany

From a content-related perspective, warning messages of the app NINA satisfy all relevant criteria that are needed for a notification of such kind to be effective, as written by Bean in 2015. Within a NINA push notification itself, the *source* of the information, the type of *hazard*, and the *location* are presented. When users open the app by tapping on the notification, the time of the alarm, the estimated duration of the hazard, and *guidance* information on how to act accordingly is provided. Additionally, the warning messages all follow a consistent format and order of information being displayed. This may allow for users to become habituated to that standard way of information presentation and, therefore, to know immediately where to find the data that is needed in order to act safely and appropriately (Bean, et al., 2015).

Aside from the content and structure of warning messages, it can be argued that a dominant indicator of a system's effectiveness is the number of people that make use of and benefit from the system. As explored in the introduction of this paper, 57 million citizens within Germany are estimated to own a smartphone (Statista, 2018). This number represents about 69 percent of the population of the Federal Republic of Germany. Out of these, 4.2 million people have downloaded the app NINA, which equals to a value of roughly seven percent of German smartphone owners who potentially use the app NINA. These numbers are likely to remind one of similar statistics compiled by Reuter, Kaufhold, Leopold, and Knipp in 2017, who found that out of 1369 respondents in Germany, only 16 percent have ever downloaded any kind of emergency information app. It has to be considered that this survey was not limited to the app NINA, but any kind of app that serves a similar function.

According to the interviewee from the BBK, the most common apps in Germany are NINA, KATWARN, BIWAPP, and WarnWetter published by the German Meteorological Service. As ascertained during interviews of this report, the publishers of these four apps work in cooperation. The apps NINA, KATWARN, and BIWAPP all feature identical warning messages due to the MoWaS system, but only the app NINA also includes information provided through WarnWetter, as well. Should the plan in Germany be to continue working with emergency information apps, it appears beneficial to have an arsenal of multiple applications. In this way, potentially more citizens can be reached and, as it became apparent during interviews with users, some people prefer one app more than the other as menu structures and methods of displaying information slightly vary. The results from the interviews present that this can be a matter of personal preferences.

Although the app NINA only allows for communication in a one-to-many structure since the BBK and control centres can share information with users but users cannot share information with

each other, it is more than just a simple warning messenger. The interactive map view of affected locations and the emergency tipps are two additional menus of the app that use textual and graphical information with a high information density. Additionally, the contact menu of the app provides links to further information websites and contact information for different departments of the BBK, should there be anything that a user would like to inform or be informed about. As found in a study by van Dijl, Zebel, and Gutteling in 2018, if social-media-like functions are added to a warning system such as NL-Alert in the Netherlands, the level of information sufficiency of users was identified to be significantly higher than without these features. Although the app NINA does not embody a social-media-like app, it does provide approaches to get into contact with authorities and makes use of various visual elements, such as the interactive map, informative images, and options of customisation. As found out during the interviews conducted with users, some greatly appreciate these means as they allow for a high information density and ways of adapting the application to the individual's needs and wants.

From the results of the current study, it cannot be derived what the average opinion of users about the app NINA is. Moreover, what this paper aims for is to provide detailed insights into experiences that interviewed users had with the application. These results may not only be useful for the future development and improvement of the app NINA but can also provide a general impression of which kinds of features users appreciate or depreciate in emergency alert applications of such kind. A very dominant outcome is that all interviewees agree that NINA is a very useful app for all members of the public who own a smartphone. All responding users viewed the app as a potentially future-oriented tool. Nevertheless, it was mentioned frequently that the application can only be truly effective if a significant number of citizens have installed it. Especially the respondents who are employed within fire departments emphasised a perceived need for adequately educating citizens not only about the existence of NINA but also with regard to other warning systems in Germany and how to understand them. According to them, it is essential that citizens are well informed about existing warning channels and the seriousness of potential risks.

On behalf of the usefulness of the app NINA for members of help organisations and fire departments, half of the respondents mentioned that it can be of good use as an additional source of information, in combination with other warning systems. The other half were convinced that other professional warning channels are to be seen as a lot more relevant in the professional context and that NINA should be limited to general civil use. Overall, this is what the application appears to be originally designed for.

At last, it is relevant to keep in mind that Germany, as a state of the European Union, also holds a responsibility to implement a public warning system targeting mobile end devices according to the legislation about Paragraph 1, Article 110 of the European Electronic Communications Code:

> ”By 42 months after entry into force, Member States shall ensure that, when public warning systems regarding imminent or developing major emergencies and disasters are in place, public warnings are transmitted by providers of mobile number-based interpersonal communication services to end-users concerned […]” (EENA, 2018).

In Paragraph 2 of Article 110, further specifications are explained as follows:

> “Notwithstanding paragraph 1, Member States may determine that public warnings be transmitted through publicly available electronic communications services other than those referred to in paragraph 1 and other than broadcasting services, or through internet access service or a mobile application relying on an internet access service, provided that the effectiveness of the public warning system is equivalent in terms of coverage and capacity to reach end-users including those only temporarily present in the area concerned, taking utmost account of BEREC guidelines. Public warnings shall be receivable by end-users in an easy manner” (EENA, 2018).

As of today, the system of the app NINA can be defined as a mobile application functioning with internet access. Therefore, although there is currently no cell broadcast system implemented in Germany, NINA might qualify as a public warning system in line with the standards demanded within the European Electronic Communications Code defined by the European Union. However, as the representative respondent of the BBK stated, it is not yet certain what the future standard technology for alerting citizens will be in the Federal Republic of Germany and, as of now, the app NINA will continue to function as part of a multimodal system.

4.4 Limitations of the study and incentives for future research

Although a significant amount of qualitative information has been collected over the course of this research process, there are limitations to the study which should be taken notice of. One relevant aspect is that the users of NINA interviewed for this study are all employed either within a civil protection and help organisation or a fire department. Although this sample of participants is generally experienced with the topics of risk, hazards, and warning systems, these interviewees might not be accurately representing the opinions and experiences of the average civil user of NINA. Due to their work background, it became apparent that most respondents were very critical about the general organisation of warning systems in Germany and conveyed their experiences from a professional standpoint. On behalf of this issue, I would like to provide an incentive for research (qualitative and quantitative) on a representative scale, including a sample of average civil users of the app NINA. In this way, more information can be collected about opinions and experiences of users, which can be applied in adapting and tailoring a system that represents and adequate balance

of citizens' needs and wants and properly realised conditions as expected by the European Electronic Communications Code of the European Union.

5 CONCLUSION

As the representative of the BBK has conveyed, there is no aim to transform the app NINA into a stand-alone system with the goal of utilising it to potentially reach Germany's entire population. The strategy of managing a multichannel programme such as the MoWaS system may not be as ambiguous as it might seem to some at a first glance. It is highly unlikely that any single information channel will be the most accessible and convenient solution for every citizen in a nation. As the statistics convey, just roughly 69 percent of Germany's population owns a smartphone (Statista, 2018) and people who refuse to buy such a device self-evidently shall not be compelled to do otherwise. Unavoidably, this means that, as of today, not more than 69 percent of the population in Germany are able to be alarmed using public warning system as defined by Article 110, no matter if the technology of concern is a mobile application or a cellular broadcast technology. The future developments within the European Union will demonstrate, whether a standardised European system will emerge and whether such a homogeneous system will help to achieve the goal of making citizens more aware and better prepared for potential risks affecting them.

REFERENCES

Apple Inc. (2015, June 05). NINA. Retrieved March 5, 2019, from https://itunes.apple.com/us/app/nina/id949360949

Apple Inc. (2019, April 02). About emergency and government alerts on iPhone and Apple Watch. Retrieved June 7, 2019, from https://support.apple.com/en-us/HT202743

ARD.de. (2019, February 21). Fernsehnutzung im Überblick. Retrieved February 21, 2019, from https://www.ard.de/home/die-ard/fakten/ard-mediendatenFernsehnutzung_im_Ueberblick/408976/index.html

Bandura, A. (1997a). Self-efficacy: *The exercise of control*. New York: Freeman.

Bean, H., Sutton, J., Liu, B. F., Madden, S., Wood, M. M., & Mileti, D. S. (2015). The Study of Mobile Public Warning Messages: A Research Review and Agenda. *Review of Communication, 15*(1), 60-80. doi:10.1080/15358593.2015.1014402

Bittner, R., Günther, K., & Merz, B. (2009). Naturkatastrophen in Deutschland. *Hochwasserschutz Und Katastrophenmanagement, 6*, 7–10.

Bundesamt für Bevölkerungsschutz und Katastrophenhilfe (BBK). (2019). Warn-App NINA. Retrieved April 10, 2019, from https://www.bbk.bund.de/DE/NINA/Warn-App_NINA.html

Charanzová, D. (2017, August 31). Compromise Amendements 17-52 [PDF]. Strasbourg: European Parliament.

Dijl, D. E., Zebel, S., & Gutteling, J. M. (2018). Integrating social media features into a cell phone alert system for emergency situations. *Journal of Contingencies and Crisis Management,* 1-10. doi:10.1111/1468-5973.12251

European Emergency Number Association. (2018, November 14). *Emergency calls in the upcoming EU-legislation* [PDF]. Brussels: European Emergency Number Association.

Gutteling, J. M., Kerstholt, J., Terpstra, T., & Van As, N. K. (2014). Gebruik en effecten van NL-Alert (Rep. No. WODC-project 2215). WODC, ministerie van Veiligheid en Justitie. Retrieved February 28, 2019, from https://repository.tudelft.nl/view/wodc/uuid:7c7de725-88b5-4654-825c-3c30c601913f.

Gutteling, J. M., Terpstra, T., & Kerstholt, J. H. (2017). Citizens' adaptive or avoiding behavioral response to an emergency message on their mobile phone. J*ournal of Risk Research, 21*(12), 1579-1591. doi:10.1080/13669877.2017.1351477

ICulturE. (2016, June 6). Controlebericht NL Alert [Digital image]. Retrieved April 30, 2019, from https://www.iculture.nl/nieuws/nl-alert-controlebericht-6-juni-2016/

International Association of Fire and Rescue Services. (2018, November 20). European Parliament makes Reverse 112 public warning systems mandatory on mobile phones for all member states. Retrieved February 24, 2019, from https://www.ctif.org/index.php/news/european-parliament-makes-reverse-112-public-warning-systems-mandatory-mobile-phones-all

Katwala, A. (2018, November 15). To tackle terror attacks, European countries are turning to SMS alerts. Retrieved February 24, 2019, from https://www.wired.co.uk/article/112-number-eu-warning-system-reverse

Kievik, M., & Gutteling, J. M. (2011). Yes, we can: Motivate Dutch citizens to engage in self-protective behavior with regard to flood risks. *Natural Hazards, 59*(3), 1475-1490. doi: 10.1007/s11069-011-9845-1

Merriam-Webster. (n.d.). Emergency. Retrieved March 5, 2019, from https://www.merriam-webster.com/dictionary/emergency

Ministerie van Veiligheid en Justitie. (2013, April). *Safety Regions Act* [PDF]. Den Haag.

Ministerie van Justitie en Veiligheid. (2018, December 19). Driekwart van de Nederlanders ontving NL-Alert controlebericht op mobiel. Retrieved March 5, 2019, from https://crisis.nl/nl-alert/nieuws/driekwart-van-de-nederlanders-ontving-nl-alert-controlebericht-op-mobiel/

Mithas, S., Krishnan, M. S., & Fornell, C. (2005). Why Do Customer Relationship Management Applications Affect Customer Satisfaction? *Journal of Marketing, 69*(4), 201–209. https://doi.org/10.1509/jmkg.2005.69.4.201

Möller, N., Hansson, S. O., & Holmberg, J. (2017). Chapter 11 Risk Communication. In *Handbook of Safety Principles* (pp. 235-257). Hoboken: Wiley.

Reuter, C., Kaufhold, M., Leopold, I., & Knipp, H. (2017). KATWARN, NINA, OR FEMA? MULTI-METHOD STUDY ON DISTRIBUTION, USE, AND PUBLIC VIEWS ON CRISIS APPS. In Proceedings of the 25th European Conference on Information Systems (ECIS). Retrieved April 29, 2019, from https://aisel.aisnet.org/ecis2017_rp/139/

Rimal, R. N., & Real, K. (2003). Perceived Risk and Efficacy Beliefs as Motivators of Change. *Human Communication Research, 29*(3), 370-399. doi:10.1111/j.1468-2958.2003.tb00844.x

Slovic, P. (2000). *The Perception of Risk*. London: Earthscan Publications, Ltd.

Smith, R. A., Ferrara, M., & Witte, K. (2007). Social Sides of Health Risks: Stigma and Collective Efficacy. *Health Communication, 21*(1), 55-64. doi:10.1080/10410230701283389

Statista. (2018, February). Smartphone-Nutzung in Deutschland bis 2018. Retrieved February 21, 2019, from https://de.statista.com/statistik/daten/studie/198959/umfrage/anzahl-der-smartphonenutzer-in-deutschland-seit-2010/

Statista. (2018, July). Radio hören: Tägliche Nutzungsdauer 2018 | Statistik. Retrieved February 21, 2019, from https://de.statista.com/statistik/daten/studie/4554/umfrage/radiohoeren-taegliche-dauer-seit-1995/

Statista. (2018, November). Handy, Smartphone - Vertrag oder Prepaid in Deutschland 2018 | Umfrage. Retrieved June 7, 2019, from https://de.statista.com/statistik/daten/studie/176644/umfrage/handy-vertrag-oder-prepaid/

Statistisches Bundesamt (Destatis). (2019, March 19). Schätzung für 2018: Bevölkerungszahl auf 83,0 Millionen gestiegen. Retrieved June 7, 2019, from https://www.destatis.de/DE/Presse/Pressemitteilungen/2019/01/PD19_029_12411.html

Veiligheidsregio Groningen. (2018). NL-Alert [Digital image]. Retrieved April 30, 2019, from https://www.veiligheidsregiogroningen.nl/wat_jij_kan_doen/voor_een_crisis/nl-alert/

APPENDICES

Appendix A

Semi-structured interview scheme for users of the app NINA

1. Since when are you using the app NINA?

2. Approximately, how often do you use the app during a week?

3. Is the usage...?

(a) optional;

(b) recommended within the organisation;

(c) mandatory within the organisation.

4. Do you use the app to...?

(a) receive push notifications about incidences that are occurring in your region;

(b) access the map view for the display of incidences that are occurring in Germany;

(c) be informed about emergency tips with respect to different kinds of incidences.

5. How would you describe your general experience with the app?

(a) Very good

(b) Good

(c) Mediocre

(d) Poor

(e) Very poor

5.1 Why?

6. According to your opinion, using the app for members of help organisations is...?

(a) useful;

(b) not useful.

6.1 Why?

7. According to your opinion, using the app for all members of the public is...?

(a) useful;

(b) not useful.

7.1 Why?

8. Do you know whether colleagues of yours are using the app as well?

(a) yes, I know that some do;

(b) no they do not / unknown.

9. Is the app being addressed or discussed within your organisation?

(a) Very often

(b) Often

(c) Sometimes

(d) Rarely

(e) Never

10. Imagine you were able to change or add something within the app. What would that be?

Appendix B

Semi-structured interview scheme for the German Federal Office of Civil Protection and Disaster Assistance

1. Do you know about the European Union legislation, for all member states, that in the next few years, each member state should have introduced a so-called reverse 1-1-2 system: a system with which authorities can quickly inform citizens in disaster or danger situations via the mobile phone?

(a) Yes

(b) No

2. Is the NINA app already considered to be such a system (does the APP NINA fall under the definition of reverse 1-1-2 systems), or is there a plan to make the NINA app such a system? (a) The NINA app is already such a system;
(b) The NINA app will be extended to become such a system;

(c) The app NINA is not and will not be such a system;

(d) Not known.

3. How many people downloaded the app NINA and how many people use the app regularly?

4. Are there any demographic statistics regarding the users of the app (age, gender, etc.)?

5. How often is the app used annually to inform citizens in emergencies?

6. Given the intention to motivate as many citizens as possible to download and use the app, what measures are being taken to achieve that?

7. Do these measures show the desired effect and are there any plans for the future to increase the number of users?

8. How to make sure that the information transmission works without misunderstandings?

9. What measures are being taken to make citizens feel better prepared for dangers and catastrophes and to be able to act?

10. If you look at the German population as a whole, the app NINA is still relatively unknown. What is being done by the Federal Office to build trust with citizens, so that the contents of the app are perceived as authentic?

11. How is it ensured that citizens are aware of the consequences of various threats?

12. Does the BBK receive feedback from users about the NINA app and how is this feedback taken into account or included?

13. Are examinations or surveys carried out in order to know in hindsight, whether notifications were understood correctly, or whether citizens acted accordingly after notifications accordingly?

14. Were there any false alarms?

15. To what extent do you consider the NINA app as a tool that can be used to actually inform the entire population in Germany?

Appendix C

Semi-structured interview scheme for the representative of the Dutch Ministry of Justice and Security

1. Do you know about the European Union legislation, for all member states, that in the next few years, each member state should have introduced a so-called reverse 1-1-2 system: a system with which authorities can quickly inform citizens in disaster or danger situations via the mobile phone?

(a) Yes

(b) No

2. Is NL-Alert already considered to be such a system (does NL-Alert fall under the definition of reverse 1-1-2 systems)?
(a) NL-Alert is already such a system;
(b) NL-Alert will be extended to become such a system;
(c) NL-Alert is not and will not be such a system;
(d) Not known.

3. How often is NL-Alert used annually?

4. Have any false alarms occurred yet?

5. Assumed the intention of motivating as many Dutch citizens as possible to receive NL-Alert notifications, specifically, what steps are taken to incentivise people to inform themselves about NL-Alert and adjust their phones to be able to receive the notifications?

6. Are means of informing the public about the existence of NL-Alert successful and how can future steps be taken to motivate even more citizens to get involved?

7. What steps are taken to increase the chance that citizens receiving an NL-Alert adequately understand the information and what is done to reduce ambiguities?

8. What measures are performed, via the channel of NL-Alert, to get citizens to feel adequately prepared to properly behave and act in various emergency situations?

9. In which ways do the Veiligheidsregios build trust to Dutch citizens, in order to ensure that people receiving an emergency notification will trust the authorities as risk managers?

10. How is it ensured that receivers of NL-Alert notifications are adequately informed about possible consequences and dangers of the emergency situation (e.g. In case of an evacuation due to a fire, how does a citizen know if their street is also affected by evacuation measures)?

11. Are you taking into consideration feedback and recommendations from citizens for NL-Alert?

12. Is there any kind of research being done with the purpose of further improving NL-Alert in the future?

13. To what extent do the Veiligheidsregios investigate whether NL-Alert messages are being understood as intended and whether citizens adequately react to the emergency?

14. To what extent do you deem the system of NL-Alert a tool suitable to be the future of notifying Dutch citizens about emergencies in their proximity?