MENTAL MODELS RESEARCH ON RISK PERCEPTION BASED ON TWITTER ANALYSIS – A CASE STUDY OF ABNORMAL HEAT IN RUSSIA

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Abstract: *along with globalization, an increase of infrastructure, new technologies' appearance social networks are becoming a rapidly growing source of information and plays important role in risk communication, which is bringing new opportunities for studying different risk perceptions. The present work is focused on the analysis of interconnected natural and social risks. In this paper, we conduct a case study of abnormal heatwave occurred in Russia in summer 2017 and described a mechanism of risks interconnectivity based on Twitter users risk perceptions. By analyzing Twitter messages with keywords "abnormal heat", we illustrated public risk perceptions in terms of interconnected and interdepended environmental and social risks and also found out distinctive features of a present risk communication system in Russia.*
Keywords: *risk communication, risk perception, Twitter, microblogging, social network analysis.*

ИССЛЕДОВАНИЕ ВОСПРИЯТИЯ РИСКА НА ОСНОВЕ МЕНТАЛЬНЫХ МОДЕЛЕЙ И АНАЛИЗА ТВИТТЕРА НА ПРИМЕРЕ АНОМАЛЬНОЙ ЖАРЫ В РОССИИ

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Аннотация: *наряду с глобализацией, улучшением инфраструктуры и повсеместным появлением новых технологий, социальные сети становятся быстро распространяющимся источником информации и играют роль в риск-коммуникациях, что приносит новые перспективы и возможности в исследовании восприятия риска. Данная работа сосредоточена на анализе взаимосвязанных природных и социальных рисков. В данной статье был рассмотрен пример аномальной жары, возникшей на территории России летом 2017 года, и был описан механизм взаимосвязи рисков, основанный на восприятие риска пользователями Твиттера. Анализ сообщений Твиттера, содержащих ключевое понятие «аномальная жара», позволил проиллюстрировать публичное восприятие риска в рамках взаимосвязи и взаимозависимости природных и социальных рисков, а также выявить отличительные черты системы риск-коммуникаций в России на современном этапе.*
Ключевые слова: *риск-коммуникации, восприятие риска, Твиттер, микроблогинг, анализ социальных сетей.*

1. Introduction

Natural hazards and social disasters have always been a matter of concern both public and government, but their interconnectivity becomes a recent trend and draws more and more attention of the scholars all over the world. According to the World Economic Forum Global risk report, natural risks as extreme weather events and natural disasters are in the top 5 risks in terms of livelihood, being on the 1st and 3rd place correspondingly, and on 2nd and 4th place accordingly in terms of their impact [1]. Moreover, The Global Risks Interconnections Map 2017 illustrated the interconnectivity of these risks, emphasizing the interconnectivity of environmental, societal, geopolitical, economic and technological risks with the profound social instability.

Present research is connected with extremely hot weather conditions, also called abnormal heatwave – a natural disaster concerned with occurring increased temperature regime in Russian Federation in summer 2017. The risk of abnormal hot weather and connected with it climate change problem is becoming the matter of great concern among specialists. According to the experts of European Union, the climate change seemed to be the biggest global threat to the people's health in XXI century, while heatwaves are the most lethal weather-related hazard – about 2700 deaths related to the hot weather anomalies [2]. Studies on the effect of different extreme weather conditions and hazards also notice that more and more societal risks are becoming interconnected with natural and environmental risks.

The objective of the present research is the public perception of the extremely hot weather risk and its interconnectivity with social risks occurred on the stage of risk communication.

2. Methodology

The theoretical framework of the present research is mainly based on the mental model approach, which was introduced by Granger Morgan and Baruch Fischhoff [3]. Graphically, the mental model approach is represented by so-called "influence diagrams" – a directed network that represents the dependencies and events in a process [4]. Thus mental models allow to interpret people's risk perceptions and influence diagrams can illustrate the connotations between different perceptions.

Previously, model development in the context of research and practice in risk communication involved eliciting the conceptual maps from stakeholders via a carefully designed, open-ended interview protocol [5]. But due to the development of ICT, Twitter becoming a commonly used legitimate platform for the risk communication. It is a growing risk information source in contexts of political communication, crisis communication, brand communication, engagement around shared experiences [6]. Since the information in Twitter is available for the public and the chosen case became a matter of public concern, the messages retrieved from this social network can serve as relevant data that can show the perceptions of the non-expert participants and we suppose that Twitter can represent the public opinion in equal terms as an interview.

For the Twitter network analysis was integrated approach which is based on combining several analyzing methods from different disciplines and is recognized as the most effective approach to the analysis of media texts [7]. Among them we can differ three main methods used for the present research:

(1) linguistic analysis methods based on analyzing text at main linguistic levels such as lexical, syntagmatic, stylistic and sociolinguistic

(2) method of textual content analysis;

(3) method of discourse analysis including the linguistic side of analysis and extralinguistic side as sociocultural, physiological, political factors[8].

Step by step implementation of this approach includes (1) information gathering with the Twitter social network as a database, (2) information sampling, (3) analyzing messages connections and directions and (4) analyzing the messages' content with the use of content analysis statistical software. According to results obtained after textual content analysis and analysis of message connections, the mental model of Twitter users risks interconnectivity is drawn, where each tweet contains information which might be coded as "risk" or "benefit" of the situation in the selected case. Both risks and benefits are divided into "people-related" and "environment-related". Next is drawing Comprehensive risks interconnectivity mental model – mental model supplemented not only with Twitter users' opinion but also with the opinion of experts from Russian Ministry of Emergency situations in order to illustrate the difference between an expert and non-expert perception of risks interconnectivity. At the end based on the risk perceptions mental model and detailed results of Twitter network analysis, the mechanism of the risks interconnectivity is described.

Technical implementation of the research was based on a range of software for quantitative and qualitative analysis purposes: NCapture, NVivo, KH Coder.

3. Results and discussion

The risks interconnectivity is a process occurred during the risk communication when people based on their own subjective judgments are building different conceptions around particular risk which are connected with risk's reasons, details, assessments and consequences and involve other correlated risks. The case of abnormal heat represents the natural risk, while analysis of the Twitter content revealed that this natural risk is interconnected with other natural risks, health risks, economic risks, industrial risks.

The mechanism of risk interconnectivity occurrence was studied from the risk perception approach – we assume that the key explanation for this phenomenon lies in the process of risk perception. Thus, the analysis of risks interconnectivity mechanism was based on the assessment of peoples' risk perceptions: experts and non-experts.

As a result of the abnormal heat case study, mechanism of risks interconnectivity includes several main elements described below.

(1) Source of the information and its characteristics

The first element – information source refers to the sender of initial risk information. By initial risk information, we mean that type of the tweet which contains only information without judgment. This type of tweets is coded as sharing-information tweets and characterized by news-writing style structure, Five W's – who, what, when, where and why describing the particular event:

Who – natural risk

What – what happened

When – a time when risk situations occurred

Where – a place where it occurred

Why – natural cataclysm or people-involved disaster

(2) Stage of the communication when the interconnectivity occurred

Most part of the basic risk interconnectivity perception is occurring at the stage of sharing risk information – 47%; 35.3% – at the stage of gathering and integrating information; and 17.7% at the stage of individual participation. Taking in consideration, the activity of different types of actors on each stage, we can conclude, that initial risk interconnectivity conceptions are belonging to the mass media who are sharing the information already contained some judgments. Next are the private users at most (53.2%) and public accounts at least (46.8%) who are gathering information from different sources, integrating it and based on it make new interconnectivity concepts. While users who feel involved in the risk situation are adding more judgments based on their participation.

(3) Information leaders influenced the interconnectivity process

In case of abnormal heat main sources of sharing information messages were either mass media accounts (52.2%) or private users (47.8%). Characteristics of the information source mainly include efficiency in spreading the news and its credibility. Efficiency means how many destinations (receivers) can information reach. In case of Twitter risk communication, the efficiency parameter depends on the number of the information source's followers. According to the top users ranked by the number of the followers, both news agencies and private accounts can be efficient information sources with a small predominance of private users over public news agencies: 54.2% over 45.8% accordingly. Taking into consideration the low percent of trust to the individual bloggers (6%) comparing with mass media (61%) [9], mass media agencies are more likely to become an information leader.

(4) Keywords of the message building interconnected concepts

Analysis of word associations co-occurrence allowed to track the keywords and keyword associations that formed a basis for risk interconnectivity conceptions of Twitter users.

Among the frequently mentioned people-related risks are powers supply system risk (34.9%), high mortality level risk (25.6%) and health risk (20.9%). For instance, powers supply risk was defined by such keywords as "energy system", "continue", "black-out", "ministry of energy" and connected the interrupted electricity supply to several regions caused by the abnormal heat to the extent of total blackouts in Crimea peninsula. High mortality level risk caused by the abnormal hot weather is described by "die", "thousands", "threat", "death". "reason" keywords. Health risk interconnectivity includes such mentions as "heart sufferer", "doctors", "faint", "fall", "ambulance" which explains the interconnectivity with increased health risks for certain categories of people, especially having problems with heart – risk of insult or other cardiovascular diseases and connected with it increase frequency of ambulance help cases.

Among environment-related risks, Twitter users are mostly aware of extreme weather conditions risks – 72.7% of all environment-related risk messages. These messages are characterized by such keywords as "hail", "abnormal", "fog", "thunderstorm", "hurricane", "shower rains", "strange", "frost". Another significant part of the environment-related risks is global climate change featured with a change of usual temperature regimes. Keywords, in this case, include "maximum", "temperature", "permafrost", "forecast", "scientists". Correlation with wildfire risks includes mentions of "fire", "forest", "danger", "victim".

As to benefits, interconnected with the abnormal hot weather, Twitter users noted severe weather alert system work that can be tracked with such keywords as "red level", "notification", "alert", "warning".

(5) Order of interconnectivity conception's occurrence

The order of the interconnectivity connotations' occurrence in public minds showed the higher correlation and with such types of risk as a health risk, mortality risk, global climate change risk, extreme weather events risk, power supply system risk and traffic complications risk. Twitter users see these types of risk as a prior in terms of their interconnectivity and interdependency. Besides, among the first perceptions was the interconnectivity of the natural risk of abnormal heat with the national alert system and public warnings and notifications.

(6) Information message's details: emotion-colored or neutral

The details of the information messages that potentially can form interconnectivity concept revealed that in case of abnormal hot weather, only 2 concepts were emotion-colored: conception about temperature records (interconnectivity with global climate change) and conception about the severe weather warning system's work. Most of the interconnectivity concepts – 88.2% – are neutral without expressing any emotions. Most of the tweets expressing emotions don't contain risk interconnectivity information and cannot serve as a reasonable source for the research, while neutral-oriented messages contain facts and can serve a credible base for the risk interconnectivity mechanism.

(7) Features of the interconnectivity: opinion-based or information-based

Features of the interconnectivity – whether it is opinion-based or information-based can explain a reasoning process of the interconnectivity. Information-based interconnectivity means that interconnectivity concepts occurred as a result of perceiving specific facts about the risk provided by information message. Opinion-based interconnectivity means that interconnectivity concept occurred as a result of reasoning processes occurred in people's mind and described in their opinion upon their risk matter. In case of abnormal hot weather, research claimed that 76.5% of concepts on average are information-based and 23.5% are opinion-based, which proves

the less meaningful role of individuals' personal perceptions in the process of risk interconnectivity in a comparison with information provided about the risk by information leaders. Detailed findings of the research showed that concept described the interconnectivity of heatwave with power supply system was partly opinion-based with mentions of criticism. Other opinion-based concepts, such as global climate change risk and related with it change of usual weather conditions, traffic problems connected with road surface melt and such heatwave benefit as an opportunity for a city get-away were based on the people's personal opinion.

(8) Details of the receiver's background: expert or non-experts

Visible gaps in the risk perceptions on the abnormal hot weather case that occurred between experts and non-experts bring to a conclusion, that details of the receivers backgrounded play important role in the mechanism of risks interconnectivity. Experts interconnectivity conceptions are distinguished by deeper analysis of the interconnected risk.

For instance, both experts and non-experts noted the interconnectivity with global climate change. However, if non-experts mentioned only temperature records and change of usual weather conditions, experts added the climate zones shift concept and caused by that botanical and biological species mutations and changes that are connected with animals' migration and appearance of new unknown infections and unpredictable health risks, as well as solar activity increase which also affects people health.

On the other side, experts ignored benefits of the abnormal heat that were found by Twitter users: an opportunity to check alert notification system efficiency; reduce of the working time in some regions; continuous road and highway repairmen.

To sum up, experts' interconnectivity conceptions are noted by scientific approach, while non-experts' conceptions – by more applied approach being more meaningful in the daily life: traffic problems and measures to prevent it; beach sanitary conditions and opportunity to rest and go to suburbs on the weekend, faint risk and free showers to prevent it. Experts' conceptions are more detailed, logically based and oriented on the scientific proves of the interconnectivity.

4. Conclusion

The interconnectivity of different types of risks is a new field of the risk communication studies. The findings of the present research are an important step for the risk communication studies in Russia. Firstly, the direct link was established between risks interconnectivity and risk perception. Secondly, our study showed the opportunity to follow the development of new information technologies and study risk through the social network analysis – analysis of Twitter. Thirdly, we provided new insights into the current conditions and features of the risk communication in Russia, which can be used for its improvement.

Findings of this research indicated the necessity to improve risk communication through social networks and particularly through Twitter. The level of involvement of both mass media and general public reveals the potential of Twitter as an effective tool for gaining up-to-the-minute information. In case of risk situation, not only mass media's and news agencies' journalists but also public in the real-time can play the role of "citizen reporters"[9] to provide instant situation reports. These reports in its turn can be used for coordinating risk prevention actions and risk management actions between citizens and between public and government.

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