

DISASTER PREPAREDNESS AND SUSTAINABLE DISASTER RISK MANAGEMENT IN A CHANGING ENVIRONMENT

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ABSTRACT

The cost of climate change-related disasters in terms of the lives lost and the damages to the social, economic and environmental assets are predicted to be higher. Disaster risk management is one of the crucial pillars with which to face this emerging trend in order to ensure the goals of are achieved sustainable development. However, the sustainability of the disaster risk management development is also significantly more complicated in changing conditions. It is necessary to look for ways to build a disaster-resilient society. This paper focuses on exploring the possibilities of supporting the sustainability of the disaster risk management through the involvement of the general public into it. The objective of this paper is to present the results from assessing the preparedness for the disasters in the Slovak Republic with an emphasis on the changing climate and environment (from population perspective). The research is based on the exploration of the questionnaire survey's results aimed at investigating the preparedness and preventive proactive behaviour of the population against the disasters. The results suggest that the disaster risk awareness and overall disaster preparedness level is rather poor and the population is inactive. The proactive behaviour of the respondents against the disasters is partially affected by some of their personality and socio-economic characteristics; especially, the younger respondents currently incline more toward adopting the protective measures. In addition, other aspects, e.g. the negative experience with the disasters in the past have an influence on the preparedness. The possibilities of increasing the preparedness of the population and their engagement into sustainable disaster risk management system are also discussed in this paper.

Keywords: disaster preparedness, sustainability, disaster risk management, questionnaire.

1 INTRODUCTION

There is a lot of discussion about the influence (or possibilities) of the Disaster Risk Management (DRM) on achieving the goals of sustainable development [1]–[6]. This is because there are a number of threats that could negatively affect the realization of these goals in the form of specific disasters. The well-established DRM, the Disaster Risk Reduction (DRR) in particular, should prevent these threats and events, reduce the likelihood of their possible occurrence, ensure an effective preparation and response to potential impacts, as well as ensure an effective recovery after a disaster. However, the sustainability of the implementation and development of the DRM is in changing conditions related mainly to the global-related changes, e.g. climate change, also an important question [7]–[9].

Sustainability in this area is a feature that will ensure that the DRM can be implemented and developed not only in the current conditions, but also in conditions that are likely to change in the near future. The climate change-related disasters and their negative effects are projected to increase in frequency and intensity [10]–[17]. The cost of disasters in terms of the lives lost and the damages to the social, economic and environmental assets are predicted to be higher. The DRM should be flexible enough to be as independent as possible of the conditions in which it is implemented. A prudent approach to change would include a range of early adaptation interventions before the onset of the climate crisis. Combined with well-designed response measures, this will accelerate the society's recovery and support more effective damage management and overall recovery (Build Back Better – BBB) [18],



[19]. Each iteration of the disaster management cycle will improve risk reduction in the future and support the building of a resilient society and its development [20].

It is necessary to make sure that the uncertainty in which the DRM is implemented causes no difficulty for such a system. One of the possibilities is to change the approach to the preparation and management of crisis events from the event-based approach to the process-based approach, or their combination. More support should be given to a procedural system that does not, in principle, take into account the type of an event, but guarantees that all the important tasks are fulfilled. Several approaches tend to believe that the inclusion of society (communities, people) in the DRM or the DRR is the mainstay of such an approach [21]–[25]. At the same time, the importance of the position of the public is emphasized in the framework of building a resilient society, vulnerability-reducing, or the abovementioned BBB principle [26], [27].

In the conditions of the Slovak Republic (SR), there is an obvious gap concerning society engagement in the DRM activities [28]. The inclusion of the public in this system is unclear and it requires a higher level of government support, but also citizens' initiatives. It can be stated that both components are currently at a low level. This gap needs to be in the context of climate addressed promptly. Initiating change requires knowing the factual state of people's preparedness as well as the determinants that affect it. Subsequently, it is possible to address factors that have a significant impact on the level of preparedness itself. For this reason, a survey was conducted to clarify the current state of the public preparedness to deal with a future disaster. The summary of the findings can be a basic point for designing particular initiatives that can systematically support the DRM activities in the SR and last but not least, can serve as a support for building a resilient society against disasters [29].

2 RISK AND DISASTER PREPAREDNESS

There are several definitions of the population (or individuals) preparedness for disasters. According to the IFRC, disaster preparedness refers to measures taken to prepare for and reduce the consequences of disasters [30]. This means anticipating and, where possible, preventing disasters, mitigating their impact on vulnerable populations and responding to their impacts. In conditions of the SR, disaster preparedness means theoretical knowledge, practical skills and habits of the self-protection [31], [32]. In other words, it is the ability and capabilities of people to protect themselves and to mitigate or prevent the impact of a crisis by their own means and forces, but also to be able to provide help to loved ones and those who are in need. Kitagawa defines preparedness (for a wide range of entities: government, state administration, response and recovery organizations, communities and individuals) as: "the knowledge and capacities developed by mentioned subjects to effectively anticipate, respond to and recover from the impacts of disasters" [33]. It can be seen from the definitions that the IFRC the objective aspect of preparedness and the others emphasizes also the importance of the subjective aspect of preparedness (knowledge, protection habits).

Objective disaster preparedness is defined by Russell et al. [34] on the example of an earthquake on the basis of three aspects of preparedness: (1) structural aspect – known also as adopting the hard measures (e.g. protective structures or technologies, etc.) [35]; (2) planning aspect – known as adopting (preparing) the soft measures (e.g. plans, instructions, policies, methods of communication) [36], [37]; (3) survival aspect – known also as capacity aspect (supplies and resources of any kind from water pumps, sandbags, aggregates or evacuation capacities to information sources and financial reserves, etc.) [38]. These capacities should serve individuals or households to handle and bridge the period when the effects of a disaster threaten their safety and disrupt the basic needs of everyday life. From the recovery point of view, in addition to material capacities, financial reserves



are emphasized too [39]. These are largely dependent on the economic capabilities of the individual or the household members.

The implementation of the mentioned measures and the creation of the reserves is also conditioned by human knowledge, risk awareness and perception. It is undeniable that risk factors awareness and the knowledge of the protection options against a crisis phenomenon impacts can increase the level of public preparedness and the perception of the future risks or disasters [37]. Knowledge shapes the perception of risk and is shaped by the risk perception, and so it is with the risk awareness [40]–[42]. The investigation of the risk or disaster awareness and disaster perception may reveal insufficient or erroneous perceptions of the context that people have on the issue disasters related to the climate change, or may contribute to clarifying knowledge gaps about this issue [43]. Risk perception is usually examined and assessed on the basis of the assumption (probability) of occurrence of an event that may endanger their safety. We believe that it is important to address this factor as people who are aware that they live in an endangered area are also expected to have a proper perception of this risk. A fundamental connection can be seen here between the aspects of risk perception and risk awareness.

Disaster awareness, and disaster perception in particular, is primarily supported by people's previous experience with such an event. Several authors have described how experience affects the disaster perception and awareness (e.g. Shapira et al., 2018 [44]). Disaster experience shapes the individual's expectations of the future disasters and their behaviour [45]. Experience with disasters can motivate people to behave actively and take preventive (protective) measures [46], [47]. At the same time, it affects the subjective perception of one's own preparedness [48]. People will be aware of the shortcomings of their previous preparation and can thus better assess their ability to handle similar event in the future. These statements do not support some studies and may vary according to the type of initiating event being investigated or the actual individual's interpretation of disaster knowledge as well as previous experience. Situations that have been weak in destructive force and intensity can lead to the misleading interpretations [49]. The subjective view may therefore be distorted, but the impact of experience and knowledge on preparedness is confirmed. Disaster experience-related factors (type, severity, etc.) and their influence on one's behaviour needs to be further explored, because they still contain a certain amount of bias due to the personality differences of individuals.

The analysis of the studies and other sources points to a range of factors that are expected to affect the level of preparedness of the population for disasters. It must be said that several factors are closely related or may be interdependent, which cannot be comprehensively eliminated.

3 METHODS OF THE STUDY

3.1 Study area

The SR belongs to the countries of Central Europe, where the most frequent floods, snow calamities, storms and forest fires have occurred recently [17], [50]. The statistics of the Ministry of the Interior of the Slovak Republic show a slightly increasing tendency in the monitored interval (2013–2018), while the frequency of events in these periods fluctuates. A total of 1295 natural disasters were recorded during this period [51]. In connection with climate change, extreme weather effects such as heat waves and drought are more pronounced, with a higher frequency of these phenomena and their severity being assumed by the Slovak Hydrometeorological Institute [52].



3.2 Questionnaire survey, study sample, study variables

A structured, anonymous, self-administered questionnaire has been developed to examine aspects of disasters' preparedness. The focus of the research was mainly on young people and employed adults, as in our opinion they represent the mainstay of building a sustainable DRR. The survey was conducted in the first half of 2019 and took into account the spatial distribution of the population in order to cover different types of disasters. The questionnaire was distributed by direct link to the questionnaire via e-mail. The e-mail was sent to the randomly selected respondents from an e-mail list (they agree to participate before) and 794 questionnaires were returned and completed. The number of respondents (n) may vary from question to question.

Based on the analysis above and other studies dealing with the issue of disaster preparedness, this study focused on examining four areas (aspects) that may affect the level of the population preparedness: (1) demographic information (gender, age, education level, location of living (urban, rural), economic situation), (2) disaster experience, (3) disaster awareness, (4) disaster perception. Separately have been studied the preventive behaviour within variables "the preventive and mitigation measures adopted" (dependent variable for the study). The particular variables connected with the defined areas are shown in Table 1. This study is in selected variables focused on the experience, awareness and perception related to the floods only, as it is the most common disaster type in the SR.

Table 1: Main variables of the study.

Preparedness aspect	Disaster Experience	Disaster awareness	Risk perception
Main variables	Experience with disasters	Flood-prone areas awareness	Fears of occurring disasters in the future
	The worst experienced disaster	Evacuation procedures awareness	Probability of occurring disasters during next 3 to 5 years
	Evacuation experience	Protection possibilities awareness	Occurrence of negative events connected with climate change
			Subjective assessment of own preparedness for disasters

The most of the nominal variables (responses) were transformed into dichotomous form (responses 0 = factor absent or 1 = present; e.g. the preventive and mitigation measures adopted 0 = No, 1 = Yes) or to the Likert scale form (from 1 to 5; e.g. feeling of safety 1=I don't feel safe, 5=I feel safe).

3.3 Statistical methods

The abovementioned transformation was done to perform multiple regression analysis with a focus on investigating the predictors of active preventive behaviour (adoption of preventive measures of any kind). "The preventive and mitigation measures adopted" was determined as a dependent variable and other factors were investigated as the independent variables.

4 RESULTS

In the following, we first outline our results in terms of our independent variables (related to basic characteristics of respondents and variables related to specific aspects of preparedness from Table 1). Next, we present the results for our dependent variables (a) respondents' effort to objectively prepare and (b) respondents' perceived level of disaster preparedness. Finally, we outline the results of our correlation and regression analysis.

4.1 Respondents' general characteristics

Of the respondents, 52.39% were men and 47.61% were women. Average age of the respondents was 29.35 years (SD 11.36 years). Respondents with secondary education predominated (59.82%), university-educated respondents accounted for 39.80%, only .38% had basic education. Respondents were roughly equally divided in terms of location of living (urban – 51.64%, rural – 48.36%). In terms of economic situation (it was measured by the financial reserves on repairs and recovery after a disaster from 1 to 5; 1 means no sufficient financial reserves), people have, on average, only enough reserves for small to medium-sized repairs (Mean, Mode, SD = 2.25, 3.00; .88).

4.2 Disaster experience variables

The respondents show a high share of the experience with floods, 57%. In total, up to 92.70% of respondents experienced a disaster and out of those respondents, 63% of them experienced it several times. From respondents which had experienced flood impacts on their own property or close relative (57.93%), the following severity impacts has been experienced: “2 = the logistic complications” – 28.3%, “3 = the minor damages on property” 25.02%, “4 = major damages on property” 28.59%, and “5 = threat for life and health” 18.01%. The average seriousness score of the disaster experienced (including, none or minimal) was 3.36 out of 5; SD = 1.42. The study results show that only 8.31% of the respondents were evacuated in the past that is a relative low share given the number of the events experienced.

4.3 Disaster awareness variables

Of the respondents, 53.16% were aware of the fact they are living in a territory endangered at least by one threat; 23.92% are aware of the living in the flood-prone zone. The respondents' knowledge about the plans and procedures of evacuation is at rate of 39.67%. 27.7% of respondents have come into contact with the topic of protecting against disasters and are aware of the possibility of protection against their effects.

4.4 Risk perception variables

The risk perception was evaluated by an assessment of four main variables. The research participants were asked to assess these variables by a 5-point Likert scale, from 1 to 5. The overall score was calculated as an average of these four items (Mean = 3.16). The following variables were assessed with following results (Mean, SD): the fears of the disasters in the future (2.25, .81); the probability of occurring disasters during next 3 to 5 years (3.00, .64); perception of the frequency of the extreme weather events and disasters occurrence in connection with climate change (3.31, .89); and subjective assessment of own preparedness for disasters (2.6, 1.01).



4.5 Preventive and mitigation measures adopted

The majority of the respondents took no preventive or mitigation measures against disasters (66.1%) and the rest (33.9%) prepared for the possible disasters through various measures or creating capacities for coping with them and survival.

4.6 Relationship between preventive and mitigation measures adopted and study variables

Results of the multiple regression analysis (Table 2) indicated that 9 of 15 investigated variables (age, economic situation, experience with disasters, the worst experienced disaster, flood-prone areas awareness, evacuation procedures awareness, protection possibilities awareness, perception of the frequency of extreme weather events and disasters occurrence in connection with the climate change, and subjective assessment of own preparedness for disasters) were significantly related ($p < .05$) to people's preventive behaviour.

Table 2: Multiple logistic regression analysis for predicting preventive behaviour.

Variables	B	S.E.	p-value	OR	Lower CI	Upper CI
Gender	-.2457	.1848	.1836	.7821	.5445	1.1235
Age	-.0312	.0100	.0018	.9693	.9505	.9885
Education	-.2924	.1970	.1378	.7464	.5073	1.0983
Location of living	.0758	.1926	.6937	1.0788	.7396	1.5734
Economic situation	.2506	.1003	.0125	1.2848	1.0555	1.5640
Experience with disasters	-.2416	.0967	.0125	.7853	.6498	.9492
The worst experienced disaster	.5322	.0765	.0000	1.7027	1.4658	1.9780
Evacuation experience	-.1277	.322	.6916	.8801	.4682	1.6543
Flood-prone areas awareness	.6826	.2287	.0028	1.979	1.2641	3.0982
Evacuation procedures awareness	.7609	.1533	.0000	2.1403	1.5849	2.8903
Protection possibilities awareness	-.8094	.2841	.0044	.4451	.2551	.7768
Fears of occurring disasters in the future	.1483	.1025	.1478	1.1598	.9488	1.4178
Probability of occurring disasters during next 3 to 5 years	-.0252	.1078	.8153	.9751	.7895	1.2045
Occurrence of negative events connected with climate change	.3315	.1056	.0017	1.3931	1.1327	1.7134
Subjective assessment of own preparedness for disasters	.4152	.1046	.0001	1.5147	1.2339	1.8594
Constant	-4.3759	.6868	.0000			

5 DISCUSSION

Following the results, people's preparedness is significantly related to their age. The younger people tend to adopt preventive measures more than older ones and they are currently



more aware of the possible negative effects related to the climate change scenarios. Our assumption is that it is appropriate to address the younger generation, which has the greatest potential to participate in the development of the sustainable DRR, also by increasing their readiness as well as the readiness of society as a whole have been confirmed. The question is how to address this potential and how to choose a suitable approach of communication with this group of the population, but also to others who cannot be excluded from this communication. As a supplementary part of the survey, we examined the preferred ways of receiving information and communication on this issue, and the results suggest that the majority of answers (80%) were dominated by indirect forms of communications (web sites, e-mails, brochures, phone apps, etc.). The rest of the answers consisted of field exercises or direct communication with experts. An equally important element of this communication is the credibility of resources (specifically media, web-portals, etc.), which can fundamentally influence the public's view of the issue [53]. However, this requires more in-depth research.

Experience is undoubtedly an important factor affecting the preparedness level. Emotions associated with the perception of climate risks are individual and specific, but often stem from the experience of a particular disaster and the subsequent solution of the situation. Understanding the importance of such a formative experience can in turn contribute to understanding how people increase their preparedness, or it can be used in preventive information campaigns or discussions as a catalyst for desirable action at the individual or collective level. Chapman et al. [48] state that a conscious emotional experience, especially in response to concepts as complex as climate change, is a combination of basic emotional states with a range of cognitive assessments as well as multiple motivational impulses. The findings of the study suggest that there is an influence of the disaster experience on people's behaviour but there is also a strong influence of other (probably) personal factors.

The American psychologist Albert Bandura came up with the concept of self-efficacy [54]. Self-efficacy can be defined as: a person's belief in his or her own ability to organize and carry out the activities needed to achieve the results – the extent to which one perceives oneself as capable of making change and achieving a specific goal [55]. Belief in the ability to successfully overcome a crisis also influences the choice of cognitive patterns that the individual uses in such situations. If a person does not have adequate social support, available resources or does not live in a functioning community with people he trusts, the level of his faith in his own ability may be low. It follows that social support (local or from the state) and community addressing of the issue also has an impact on the self-confidence of individuals, which can help increase the level of preparedness at the individual level. Our study shows that level of the self-confidence of the respondents is on average or rather low, which means that there are missing supporting factors as resources (economic), social support or disaster awareness. The second factor and the third one can be addressed by appropriate chosen policies and strategies related to the supporting of the DRR initiatives.

The economic situation of an individual or a household is a precursor to a protection action (adoption of structural measures in particular) and to the increasing rate of one's own preparedness but it is difficult to address or change within the population. It identifies vulnerable populations who need to be helped in preparation activities for the potential effects of climate change. Perceptions of one's own vulnerability (economic or other) and, at the same time, an awareness of how the risks of disasters can be reduced are key (given a specific location) [56]. The influence of risk awareness on the active behaviour of the population was confirmed by the survey, which is an important reason for increasing the population's disaster awareness and related risk awareness. However, knowledge of imminent danger must be associated with sufficient information on how to deal with the situation and at the same time the individual must be able to act in the direction of this



information. The limitations of such an activity should be removed by conceptual management and targeted help to the most vulnerable group of the population [57].

6 CONCLUSION

The population (youth and employed adults) preparedness is rather weak and people are they are less active towards increasing preparedness. Despite that, the study reveals several determinants of the preventive behaviour and causes of adopting protection measures. It is undoubtedly important to promote society's awareness of risks related to the climate change in order to support sustainable development of the DRR in the future. The challenge is to choose appropriate ways and approaches to achieve greater involvement of the society in this issue.

The required change in the level of social behaviour of the individual in the direction of sustainability and increased preparedness for disasters must be supported by institutional change, changes in laws and regulations that will empower the individual in such behaviour. The measures at the global level must be transformed into measures at the regional level and, at the same time, into measures taking place at a specific individual level with the emphasis of their effective implementation into everyday life. It is important to draw attention to the local aspects of the climate-change related events and their connection with political, public, health, agricultural and other aspects. The complexity of climate change requires an emphasis on local aspects, given their global context. Pointing out the local manifestations of the climate crisis and its connection with the life of each individual as a global, means the possibility of taking a personal position on this issue. It is the first step in arousing public interest into incorporating solutions that could mitigate the risks arising from the increase of the extreme weather events.

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