Natural Disasters´ Management and Detection of Priority Problems for Future Research

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Abstract: - Natural disasters threaten the humans from time immemorial. They are caused both by the processes in the Earth core and Earth surface, or in the atmosphere, and by the processes in the vicinity of the Planet. From the current knowledge it follows that in human system various phenomena take place in the development process that are the expression of its development or of the development of systems that create it. The research was targeted to natural disasters such as: avalanches; hot wet summer days; drought; dams rupture; floods; tsunami; earthquakes; volcanic eruptions; landslides; rocks tumbling down (rock fall); forest fires; wind storms; tornados; excessive rain or snow falls ; and gas erosions from the core. It identifies deficits at natural disaster management from the viewpoint of safe community concept that has been promoted by the EU since 2004.

Key-Words: - Human System, Natural Disasters, Management, Security, Safety, Unknowing the Disasters´ Management.

1 Introduction

Natural disasters threaten human from time immemorial. They are caused both by the processes in the Earth core and Earth surface, or in the atmosphere, and by the processes in the vicinity of the Planet. From the current knowledge it follows that in human system various phenomena take place in the development process that are the expression of its development or of the development of systems that create it. Therefore, from a viewpoint of the modern concept of a safe community, we see [1] natural disasters as common expressions of the development of systems considered and this predefines the strategy of management and behaviour of well-aware human beings. Throughout its development humans tried to reduce their and theirs protected assets' vulnerability with aim to reduce loss, damages and harms.

On the basis of the current knowledge, humans, under the management of a safety of community, try to implement measures and activities that will prevent the big impacts of natural disasters on humans and their protected assets or they will reduce them so that it will be possible to stabilize the situation in case of a disaster occurrence and to start further development of area [2].

The research was targeted to natural disasters such as: avalanches; hot wet summer days; drought; dams rupture; floods; tsunami; earthquakes; volcanic eruptions; landslides; rocks tumbling down (rock fall); forest fires; wind storms; tornados; excessive rain or snow falls; and gas erosions from the core.

The first step for ensuring the security and sustainable development is to know the disasters. Big natural disasters that are from a viewpoint of the protection and development of a human and its protected assets the most important are not evenly placed in the world and they do not even occur regularly in certain areas nor evenly in time [2]. Therefore, the basic questions connected with safety management are:

- why and where do disasters occur?
- is it possible to control disasters at least in the sense of a regulation of their occurrence?

Understandably, from a viewpoint of knowledge and sustainable development there is a very important question what exactly are the causes of disasters. Many experts sought causes of natural disasters outside of the Earth, e.g. in Sun spots (spots on the Sun surface that has a lower temperature than their vicinity). However, until

now, no direct relation was proven and also no mechanism of disaster origination was discovered by this way. Current knowledge show that the changes in the Sun's activity really have an influence on biosphere, human system and disasters occurrence, however, not directly, e.g. during the geomagnetic storms the rise in road accidents, number of heart attacks etc. is proven [2].

Natural disasters by their severity and extent have always exceeded the effectiveness of weapons made by man. The most dangerous natural disasters on our Planet are hurricanes; in the last 40 years, there were more than three quarters of million casualties because of them. The second most dangerous are floods that were the cause of two hundred thousand casualties in the same time period. Earthquakes are following they caused death of almost two hundred thousand people and finally volcanic eruptions at which more than 35 000 people lost their lives. The biggest natural disaster in human history ever recorded was in 1887 in China, where in the Che-nan province as a result of Yellow river's overflow more than 900 000 people died. Records of natural disasters are often astonishing [1]. In Europe, according to the EU statistics, the worst disaster is an earthquake. Conducted statistics show that the serious disasters in the EU area between years 1975 – 2001 were split in this way: earthquake 78%; industrial accidents 10%; floods 6% and windstorms 6%. Occurrence of disasters and their size depend on area. Size and specifics of impacts depend both on area characteristics and its population along with its industry and infrastructure [4].

We are not yet able to successfully predict natural disasters, despite the fact that already since 50's of the last century, there are prognostic polygons in various countries throughout the world focused on the selected natural disasters, e.g. [2]. Therefore, the prevention against natural disasters is done on a complex level; big disasters cause hard social situation. Sometimes, after a disaster, critical situation occurs when humans show recklessness, violence and loathsome behaviour. If panic comes about and people behave as disorganized crowd at rage. Copying with a disaster means, from a viewpoint of a human: to survive it, to which also a social adjustment is necessary. From disaster of various kind analyses, it is known that the more the behaviour of people in group is rational, the biggest chance to survive is. After the disaster, usually a process of relieve and euphoria arrives coming from the notion of managing to survive the dangers and traps. Critical danger usually leads to social solidarity increase; however, after the danger is gone, there is often an asocial tendency. Groups fall apart, individuals occurs that try to exploit the situation in their favour. Therefore, from viewpoint of prevention and copying an emergency, critical or catastrophic situation, we separate the following stages: before the disaster; during the disaster; right after it, i.e. at an emergency situation; and after the disaster's fade away, at which new relation are created. This is the stage of renovation, which is in the developed world understood as a possibility to take measures ensuring higher safety in area. E

Experiences show that at critical situation any activity is better than passivity. The least attempt of a rescue is better than leaving ourselves to fate. Defence against disasters and catastrophes (often the both terms differ only by catastrophe being a phenomenon that strike a bigger area and there is more casualties) is passive and active. Passive is mostly about building the systems securing protection against the unacceptable, and therefore, undesirable impacts of disasters (by averting impacts or at least reducing them) and at the education of people targeted on arousing this kind of behaviour at individuals and groups of people is directed to minimize the origination of disasters that are possible to avoid and if, in spite of this, disaster occurs to try make the loss the smallest possible. Active defence lie in systematic execution of real measures that eliminate disaster occurrence or at least the occurrence of the unacceptable, e.g. undesirable impacts of it [2].

At the public poll under the UN that was conducted in the most developed countries in the world in 90's of the last century, the answer to a question "what people fear the most?" was quite surprising, since it was found out that people fear the most natural disasters and big industrial accidents and that is because they have no influence on them. Because of this, many agreements and conventions were prepared under the UN that associated to this problem. From 01/01/1990 under the UN, the project IDNDR was realized, i.e. International Decade for Natural Disaster Reduction, after which project ISDR (International Strategy for Disaster Reduction) followed in 2000 being in process until now.

Natural disasters have been threat the inhabitants of our Planet since the origin of our civilization. They can cause huge damages and extent of an affected area does not depend only on their size but also on the concentration of population, industry and transport, dangerous technologies on the affected area and of course on the level of preparedness to remove their impacts [2].

Statisticians calculated that on Earth the every hundred-thousandth man losses live as a result of a natural disaster. Even though this is less than the number of casualties of the car industry (circa 250 000 a year), the number is horrifying, since natural disasters strike always at once and completely unexpectedly. They devastate a certain area; destroy homes, property, infrastructures and sources of food. After one big catastrophe more and more catastrophes succeed such as famine, epidemics, people migration, toxic substances release, omnipresent fires, networks blackouts – electricity, water, gas, heating and others [2].

Natural disasters are both, the fast and the gradual natural processes of an extraordinary size that are caused by the activity of forces inside and outside the Earth, temperatures divergences and other factors. These disasters affect continents, waters and atmosphere. They can be caused by: masses movement (earthquakes, landslides); energy releasing in the Earth core that comes along with physical and chemical processes that are transferred to the surface (earthquake, volcanic activity); ocean level increase (floods, overflows, and tsunami); extremely strong wind (hurricanes, wind storms, cyclones, tornados); atmospheric disorders (storms); and cosmic impacts (harmful radiation, meteorites).

After primary impacts caused by disaster occurrence, the secondary impacts follows that relate to human activity, e.g.:

1. At earthquake – fires, gas explosions, dam ruptures, landslides, pipelines and electricity lines breakdowns.
2. At landslides – dam ruptures, roads and railways blockage, pipelines and electricity lines breakdowns.
3. At volcanic eruptions – pasture poisoning, livestock extermination, famine.
4. At floods – well poisoning, underground water muddying, infectious diseases.
5. At storms – fires, blackouts of electricity.

On the basis of current knowledge, the big impacts of disasters are connected with following planetary phenomena: climatic changes and ecologic collapses; Earth collision with asteroids and comets; volcanic eruptions and earthquakes; and floods, tsunami, big storms; and droughts and epidemics. E.g. the fact is that the climate of Europe has warmed up – to an increase of almost 1°C, faster than the world average. Warmer atmosphere contains a bigger amount of water steam; however the new rain models significantly diverge among regions. In North Europe, snow and rain fall levels increased significantly, while on the South, the droughts are now recorded more often [3].

Studying of planetary phenomena and their impacts on humans revealed that disasters connected with planetary phenomena have occurred throughout all human history. In history, the occurrence of big planetary phenomena always had an influence on the civilization and caused extinction, origination or mass migration of human communities [2].

Geological proves on the observed planetary phenomena existed from 8000 BC. The impacts of planetary phenomena depend on their energy. Energy of big planetary phenomena exceeds hundreds of Mt TNT (1 Mt = 4.2 x 10^{22} erg), e.g.:

- summer storm has the energy of 1 kt (kt = 0.001 Mt),
- an earthquake with magnitude 8.7 has the energy of 100 Mt,
- eruption of Cracatoa volcano had the energy of 5200 Mt,
- eruption of Mount Tambora volcano had the energy of 2450 Mt,
- at the origin of Baring crater in Arizona, the Earth collided with a meteorite of a 50 m in diameter in a speed of 13 km/sec and energy of 3 Mt TNT.

The overall year energy released at earthquakes is 120 Mt, at volcanic eruptions 25 Mt and at summer storms 2400 Mt. For comparison, the atomic bomb thrown down on Hiroshima had the energy of 13 kt and the biggest hydrogen bomb launched in the Novaja Zemlja shooting range had the energy of 55 Mt [1]. The extent of damages caused by natural phenomena is huge.

It is important to observe that human society nowadays is more vulnerable since the number of inhabitants of our Planet has risen significantly along with the number of technical works that increase the vulnerability of real places and whole areas. Therefore, not only the big planetary phenomena but also phenomena of smaller force affect our society. It is also necessary to take into consideration the wholly rising awareness and this altogether can at individuals cause the idea that there are more and more disasters happening. However, the assessment of disasters according to energy, i.e. clearly defined physical quantity, the results of which are given above, shows that our Planet still works in stable regime; while it still stands “Gaia works for itself not for mankind”. Climatic changes that have recently been in the centre of attention, in case that they surpass the capacity of adaptation of human system can trigger the development trajectory of human system that will be unacceptable for mankind; therefore, it is necessary to systematically do prevention so that the

change of a current development trajectory is avoided.

As a result of a rising vulnerability of human society, the impacts of planetary phenomena on people are bigger and bigger. So that mankind could effectively protect itself against natural disaster impacts, it must work on their recognition, prediction and on the realization of all the means (technical, organizational and educational) by which it is possible to reduce their impacts [2].

2 Data and the Method Used in Research

For the level of the EU natural disaster management assessment, there were used: the data from professional domain that are cited on relevant places; and the data on legislative and on management mechanisms in the EU [5]. In the proper research, disasters were considered that relate to the followed domain, given above. The method of research lays in expert evaluation of the above-given questionnaire 1, described in chapter methods, which is compiled for the project FOCUS [6] and that is targeted on locating the deficiencies in the EU and in Member States management with regard to disaster management that is a basis for building the safe EU with sustainable development.

3 Results of research

Each of the natural disasters has characteristic physical features, e.g. it occurs suddenly, prepares gradually and affect gradually; it does or does not have the indications of an origin; extent of affection; term of affection etc. The size of natural disasters is measured according to energy or some rate that represent an equivalent of energy or according to its impacts on protected assets. In the affected site, the classification is usually done according to the size of impacts; scales with categories 1 to 3 (floods); 1 to 5 (avalanches, tsunami, landslides, hurricanes, tornados); 1 to 12 (earthquakes) etc. are used.

On the basis of critical analyses, the fact is that the response to the big natural disasters occurrence often proves many failures of various state and private bodies, organizations and institutions (e.g. at floods, the lack of flood plans; or some other time the violation of safety prescriptions, technology is in a bad condition or failure of a warning system; underestimation of historic experience – e.g. unprotected and build-up coastal areas in Portugal, vicinity of Nice, Bretagne that was affected by harmful tsunami in the past etc.) [2].

The questionnaire 1 was filled by 25 university educated experts having practical experiences (first responders, safety managers in plants and utilities, designers, system engineers, operating engineers, safety inspectors, public administration officers, academic workers, lawyers, economists, PhD students – only one political scientist) on the basis of current knowledge [1, 2, 7-64; other publications present in the CVUT registry about disasters and their management; [65-81]. Synthesis conducted by five specialists from the CVUT and Ministry of is given in table 1.

Table 1: Assessment of the level of natural disasters management in the EU

Question	**Answer** (sentence + reasons for)
Does the list of followed disasters given above contain all disasters possible in the EU territory?	On the basis of recent analyses of critical situations [9] it is necessary to supplement: geomagnetic storms that are caused by the Sun activity; desertification (desiccation until parching of extensive areas in Europe that appears as a huge fall of underground water level and on the surface as a lack of water including the potable water needed by people and animals), e.g. [67]; land erosion, e.g. [68-70]; soil salinization; e.g. [68]; fall of a cosmic body; sand storms; ocean spreading; and sudden change of weather (cold wave or heat wave).
Which disasters from the followed one are the most horrible for the EU territory?	The order is: fall of a big cosmic body on Europe; earthquake; floods; forest fires; and drought.
For which followed disasters the EU does not systematically perform prevention? Is the prevention level	The EU has no tool that would adjust the demand for the systematic prevention of natural disasters of all kind, in spite of accepting the principle of All Hazard Approach [81]. It is necessary to perceive that the prevention requires finances, knowledge, technical means and qualified personnel which require that it has to be

sufficient? What is the situation in the CR? What is necessary to improve?	enforced by legislative. The fact is that the European Committee according to legislative in force considers as natural disasters only earthquakes, avalanches, landslides and floods [65]. Since both the EU and the Member States are affected by tornados, forest fires, tsunami, drought etc., it is possible to state that the level of the prevention against natural disasters is insufficient in the EU. However, it is necessary to objectively state that the EU document [65] is targeted to a financial sector. Also in the CR, the law No 586/1992Sb. from a financial sector uses a specific definition "As a natural disaster is for the purpose of this law considered a unintended fire and explosion, strike, wind storm with a wind speed higher than 75 km/h, flood, hailstorm, soil erosion, rock tumbling down, if they did not occur in association with industrial or constructional operation, slides of tumbling down of avalanches and earthquake reaching at least the 4th degree of an international scale giving the macro-seismic effects of an earthquake. The extent of damage must be proven by the opinion of an insurance company, and that including the case where the ratepayer is not insured, or by an opinion of a court expert." According to [74, 77], in the EU, it is necessary to improve the prevention to natural disaster. In the current Czech practice the basic prevention to natural disasters is given by the construction law (law No 183/2006 Coll.) while in the original version of the previous law (i.e. law No 50/1976 Coll.) it was given in a more enumerative way. Prevention against the worst natural phenomena in the CR, i.e. the floods is in most detail given in law No. 254/2001 Coll. and in the successive legislative. In the EU, Member States and the CR, it is necessary to implement the system of management based on integral safety [2].
For which followed disasters the EU does not systematically perform preparedness? Is the preparedness level sufficient? Is the preparedness performed by all important society components (including public) sufficient? What is the situation in the CR? What is necessary to improve?	For the majority of disasters in both the EU and the CR, it stands that there are no systematic measures for preparedness taken. Since the European Committee according to legislative considers as natural disasters only an earthquake, avalanches, landslides and floods [65], its preparedness is possible to see as insufficient. It is possible to objectively observe that according to different documents, the situation in the EU is heading the right direction, e.g. according to: - [66] natural threats are: storms, droughts, floods, forest fires, landslides, avalanches; and there is proposed for them the development of the systems of early warning and improvement of strategies for prevention and mitigation, - [68] it is proposed to create the European centre for monitoring the drought and desertification, which is mentioned also in the 7th Frame Programme for research and development, and to take measures for improving the awareness about the sustainable exploiting of water, - [69] it is demanded cessation of desertification. To the request of the European Parliament, the Commission has already started pilot projects in 2010 targeted to stop the desertification with aim to spread the well-tried methods across Europe. The projects also render examples of the measures of rational and economical exploiting of water and the well-tried methods will contribute to the revision of a policy in area of a lack of water and drought, - [70] it is stated the measure in a form of stressing that the forest areas are important for preserving the nature of a landscape and fertility of soil. They avoid soil erosion and desertification, mainly in mountain or semidry areas since they reduce the water drainage and reduce the speed of wind, - [71] it is given that, mainly in south regions of the EU, it is necessary to

	introduce a common agricultural politics that will avoid the desertification and erosion of a landscape, - [72] Member States should have agreements for the fight with soil erosion and desertification or for the propagation of a comparable protecting function of forest, - [74,75] it is necessary to improve the EU preparedness to natural disasters, - [76] the Committee has an intention to pass by the end of year 2012 the plan of water sources preservation in Europe. This plan will be based on the assessment of executing the outlined directive about water, policy in the area of lack of water and drought and vulnerability of water sources as a result of climate changes and other human influence. In the CR the preparedness to natural disasters is concentrated only on floods (flood plans – law No. 254/2001Sb.). In the EU, Member States and the CR, it is necessary to implement the system of management based on integral safety [2].
For which followed disasters the EU does not systematically prepare qualified response? Is this response level sufficient? Is response prepared by all important society components (including public) sufficient? What is the situation in the CR? What is necessary to improve?	The EU does not have any systematic approach for the response to natural disasters. The individual Member States have the systems of response on various levels. In the CR, there is for the case of the response to natural disaster the Integrated Rescue System (law No. 239/2000Sb.). In the area of response, the EU has tools [77-80]: - at earthquakes, avalanches, landslides and floods – financial help, - using of the fast reaction forces, i.e. emergency reserves and key sources (mainly modules including the exploratory and rescue teams, means for the water cleaning, medical teams, means for forestall fires dealing with and for the detection and decontamination of chemical, biological, radiological and nuclear materials, also of temporary shelters and teams for the technical help and support) – readiness reserves of civil protection, - support of the volunteering - mutual help among the Member States in case of humanitarian crisis, - humanitarian help. In the EU, Member States and the CR, it is necessary to implement the system of management based on integral safety [2].
For which followed disasters the EU does not systematically prepare qualified renovation (renewal)? Is this renovation level sufficient? What is the situation in the CR? What is necessary to improve?	The EU does not have any systematic tool for the renovation after natural disasters; it has only some partial measures. The EU has Fund of Solidarity for helping the countries affected by serious disasters. According to work [73] at serious disasters, the damage of which exceeds – relatively high – threshold level, the activity of the Fund of Solidarity is quite satisfying. Criteria are clear and it is possible to evaluate them easily, the countries usually do not have problems with the preparation of demands. However, there is a problem at smaller disasters where the required prove of serious impacts of a lasting character on the economic stability of the affected region seems, from the start, as quite speculative, economically not very sure and in every case a hard task that is difficult to assess, in case of a smaller areas in particular. Until now, it was not complied with 2/3 of demands submitted according to this rule. It is clear that the fund should be able to react and render help faster and better. Even though the fund was never seen as a tool of exceptional help, it is understandable to expect that the financial help from it will be given as fast as possible. A year delays or even more are evidently too long. In the CR for renovation, there is a law No. 12/2002Sb. that adjust the help to citizens and public subjects that were affected by natural or other disaster that brought about exceptional event in sense of law No. 239/2000Sb. and at which the crisis situation was announced. In the EU, Member States and the CR, it is necessary to introduce the system

	of management based on integral safety [2].
Which followed disaster can cause the critical situations in the EU? Which followed disaster can cause the critical situations in the CR?	Disastrous earthquakes or extreme climatic phenomena that are the cause of big economic and social impacts. There is infrastructure affected (buildings, transport, energy and water supports), which represents a specific threat for the densely inhabited areas. The situation can be made worse by rising of the sea level. Strategic and long-term approach will be necessary to the territorial planning on both the continents and coastal areas including transport, regional development, industry, tourism and energetic politics.
Which followed disaster can cause the crisis situations in the EU? Which followed disaster can cause the crisis situations in the CR?	Disastrous earthquake, extreme climatic changes or other extreme disaster, at which serious mistakes occur at starting and implementing of a response and there will be no qualified management since the EU or member states governments, including the CR, will underestimate the severity of the situation and its consequences and they will not provide sources, forces and means for the survival of people early enough.
For which crisis situations caused by followed disasters in the EU the level of crisis management is not sufficient? For which crisis situations caused by followed disasters in the CR is the level of crisis management not sufficient?	In domain of natural disasters´ management under the EU, there is a lack of a mechanism for unified and targeted response of all the Member States to the critical situations evoked by whichever natural disaster. For example, in the CR, involving people is missing for the case of critical situation; they have no knowledge and they are not prepared for the systematic response in case of need and the responsibilities are not assigned to them for the case of dealing with highly extreme situations.
Where the vulnerabilities of human society in the EU can cause a change of a critical situation into the extreme situation? Where vulnerabilities of human society in the CR can cause the change of a critical situation into the extreme situation?	Natural disasters management requires the All Hazard Approach [81] and strategic management of integral safety [2]. It is necessary to consider humans and their protected assets vulnerability and to find a way that allows them to survive. However, the vulnerability of protected assets is site specific and knowledge about it is only fragmental. Research in the EU and the CR should remove the gaps. On the basis of that, it is possible to determine the requirements for strategic planning, spatial planning and territorial planning [82].
Do we have reliable methods for the determination of the scenarios of all disasters expected in the EU? Do we have reliable methods for the determination of the scenarios of all disasters expected in your country?	Only in some areas (e.g. nuclear power plants, serious nuclear and chemical industrial plants) the methods for defining the scenarios for the identification, analysis, assessment, management of risks and dealing with risks are defined; i.e. the results of methods are comparable. In other areas in the EU and the CR, there are not any unified methods, tools or techniques used in practice; i.e. the comparability is missing. Moreover, in many applications the methods are not stated at all, or their preconditions are neglected; e.g. it is used the data set that does not have properties required by the method; there are used wrong preconditions or insufficient knowledge of process that produce a natural disaster etc. Key step to improvement is to ensure in-depth research based on data and not on just copying the already-known facts; to check every result, before implementing in practice, by a public opponent management by real experts (they show professionalism, objectivity and support of public interests) and by this to avoid the influence of lobbyists. In the EU, in individual Member States including the CR, it is necessary to implement the research and application of methods that support the system of management based on integral safety [2].

Do we know for all followed disasters given above successful preventive, mitigation, response and renovation measures and activities? Which weaknesses are in knowledge on preventive, mitigation, response and renovation measures and activities?	We can briefly say that NO – there is many professional works that are of a good quality but since the most efficient are site specific measures that take into account rarities of area and its protected assets and disposal knowledge, sources, forces and means, it is necessary to direct the research so that there was the real knowledge and so that it was possible to apply procedures that were adjusted for the CR on the basis of the real data [83] and that were checked in practical applications.
What is necessary to improve?	To implement in practice the strategic management of integral safety that is systematic and proactive [2]; to oppose projects in public way and to avoid the influence of lobbyists and other insisting groups. Professional procedures are in professional publications; it is necessary so that the management system was implemented that really push the public interest through and it is designated for the protection of both the EU and the CR citizens and that quotidian even after the extreme natural disasters.
What research is the most effective for the improvement of safety management of the EU? What research is the most effective for the improvement of safety management of the CR?	Research of priority problems based on the real data and performed by qualified methods with the organisation of the public review of the results of projects will be held (to avoid duplicities and writing essays with no real credibility). Stands both for the EU and the CR.
What principles, legislation and co-operation rules in the EU are necessary for security and sustainable development of humans?	1. All Hazard Approach. 2. Legislative for the integral EU safety management support. 3. Creating of a qualified system of response to extreme situations.
Can you propose measures for averting the social crises in the EU?	1. To govern the EU with respect to public interest and with aim to ensure security and sustainable development of the EU inhabitants. 2. Not to underestimate natural disasters of any type. 3. To create a system of the EU integral safety management. 4. At the decision-making to reduce the influence of lobbyists and other insisting groups.

On the basis of data in table 1, there is judged the level of the EU public affairs management from a viewpoint of natural disasters management. It is visible that the EU legislative is not in accord with the professional knowledge; only some of the harmful phenomena are seen as disasters [65]. It underestimates the drought, there is a lack of a systematic approach based on professional knowledge, it only ensures some partial measures etc. On the basis of critical assessment based on the comparison of what should be fulfilled at the ideal integral safety management and the reality, there are identified basic deficiencies connected with followed natural disasters´ management and there are identified domains, in which it is necessary to take measures. From the result it follows that there are many deficiencies. This is caused by the fact that, in management the targeting on the priority problems is missing. Domains that lead to the reduction of the deficiencies are marked in table 2.

Table 2: Proposal of the domains of solving the identified deficiencies
Priority areas that require measures to be taken are marked in bold print. Column “Other”: M marks that it is necessary to execute relentless monitoring so that the management of the given disaster was efficient; e.g. ensuring of a early warning, quick mapping of the situation; early start of emergency actions etc.; S marks that

it is necessary to do efficient prevention since the given disaster is slow, and therefore, it is not possible to avert it with a quick response

Disaster	**List of gaps**	**Type of measures and activities for remove of gaps**				
		legislation	**specific management**	**research**	**education**	**other**
Avalanches	Prevention measures are the most efficient and they are site specific. In planning, their systematic application is necessary. The EU should pay attention so that the Member States took into account the prevention measures.	**yes**	**yes**	**yes**	**yes**	M
Sudden changes of weather (coldwave or heatwave)	The most efficient is a quick response. The EU should enforce so that all the Member States had a contingency plan, which would be activated in case of need.	**yes**	**yes**	**yes**	**yes**	M
Drought	This is not possible to underestimate and it is necessary to have a plan for an extreme drought. The EU should enforce so that all the Member States had a contingency plan, which would be activated in case of need.	**yes**	**yes**	**yes**	**yes**	M
Dam rupture	Prevention measures are site specific. In planning, their systematic application is necessary. The EU should pay attention so that the Member States took into account the prevention measures and have the efficient response plans.	**yes**	**yes**	**yes**	**yes**	M
Floods	Prevention measures are site specific. In planning, their systematic application is necessary. The EU should pay attention so that the involved Member States take into account the prevention measures and had the efficient response plans.	**yes**	**yes**	**yes**	**yes**	M
Tsunami	Prevention measures are site specific. In planning, their systematic application is necessary. The EU should pay attention so that the Member States took into account the prevention measures and have the efficient response plans.	**yes**	**yes**	**yes**	**yes**	M
Earthquake	Prevention measures are site specific. In planning, their systematic application is necessary. The EU should pay attention so that the involved Member States took into account the prevention measures and have the efficient response plans.	**yes**	**yes**	**yes**	**yes**	M
Volcanic eruption	Prevention measures are site specific. In planning, their systematic application is necessary. The EU should pay attention so that the involved	**yes**	**yes**	**yes**	**yes**	M

	Member States took into account the prevention measures and have the efficient response plans.					
Landslides	Prevention measures are site specific. In planning, their systematic application is necessary. The EU should pay attention so that the involved Member States took into account the prevention measures and have the efficient response plans.	**yes**	**yes**	**yes**	**yes**	M
Rock fall (Rock tumbling down)	Prevention measures are site specific. In planning, their systematic application is necessary. The EU should pay attention so that the involved Member States took into account the prevention measures and have the efficient response plans.	**yes**	**yes**	**yes**	**yes**	M
Forest fires	Prevention measures are site specific. In planning, their systematic application is necessary. The EU should pay attention so that the involved Member States took into account the prevention measures and have the efficient response plans.	**yes**	**yes**	**yes**	**yes**	M
Windstorms	Prevention measures are site specific. In planning, their systematic application is necessary. The EU should pay attention so that the involved Member States took into account the prevention measures and have the efficient response plans.	**yes**	**yes**	**yes**	yes	M
Tornados	Prevention measures are site specific. In planning, their systematic application is necessary. The EU should pay attention so that the involved Member States took into account the prevention measures and have the efficient response plans.	**yes**	**yes**	**yes**	**yes**	M
Excessive rain or snow falls	Most efficient is a quick response. The EU should enforce so that all the Member States had a contingency plan, which would be activated in case of need.	**yes**	**yes**	**yes**	**yes**	M
Gas outbursts from the Earth core	Most efficient is a quick response. The EU should enforce so that all the Member States had a contingency plan, which would be activated in case of need.	**yes**	**yes**	**yes**	**yes**	M
Geomagnetic storms	Most efficient is a quick response. The EU should enforce so that all the Member States had a contingency plan, which would be activated in case of need.	**yes**	**yes**	**yes**	**yes**	M
Desertification	Prevention measures are site specific. In planning, their systematic application is necessary. The EU should pay attention so that the involved Member States took into account the prevention measures and have the efficient response plans.	**yes**	**yes**	**yes**	**yes**	S
Land erosion	Prevention measures are site specific. In planning, their systematic application is necessary. The EU should pay attention so that the involved	**yes**	**yes**	**yes**	**yes**	S

	Member States took into account the prevention measures and have the efficient response plans.					
Soil salinization	Prevention measures are site specific. In planning, their systematic application is necessary. The EU should pay attention so that the involved Member States took into account the prevention measures and have the efficient response plans.	**yes**	**yes**	**yes**	**yes**	S
Fall of a cosmic body	Most efficient is a quick response. The EU should enforce so that all the Member States had a contingency plan, which would be activated in case of need.	**yes**	**yes**	**yes**	**yes**	M
Sand storms	Most efficient is a quick response. The EU should enforce so that all the involved Member States had a contingency plan, which would be activated in case of need.	**yes**	**yes**	**yes**	**yes**	M
Ocean spreading	Prevention measures are site specific. In planning, their systematic application is necessary. The EU should pay attention so that the involved Member States took into account the prevention measures and have the efficient response plans.	**yes**	**yes**	**yes**	**yes**	S

4 Conclusions

It is a fact that it is not possible to avert natural disasters since they are a manifestation of the human system development. However, professional knowledge exists by which it is possible to mitigate their impacts, or at least to mitigate the impacts on humans. Disaster management must employ this knowledge, namely by a qualified way. Currently, this takes place only in some individual cases, and therefore, it is necessary to state that the level of natural disasters´ management assessed on the basis of professional criteria for the effective protection of people and area is low in the EU; only the partial measures are taken and some of them is hard to apply (e.g. requests for financial help after not so big but harmful disaster are unclear). There is a lack of systematic approach, clear target oriented to security and sustainable development of the EU inhabitants. Research is diffused and often of a bad quality since it is not based on the real data and basic practices of a research; literal essays made for officials usually do not solve the problems. Sources for the research in the field of safety are diffused among European, state and regional levels and also between public and private participating parties. It is necessary to implement in practice the public professional review of solutions, which are proposed by research and that are applied in practice

On the level of the EU, there are hundreds of projects that have on a various level (technical, social, organizational) engaged in natural disasters. However, what is entirely missing is the synthesis of partial results into one whole concept.

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