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RISK MANAGEMENT AS PART OF CRISIS MANAGEMENT TASKS

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Abstract: The increasing number of natural disasters requires the use of preventive measures. One of the elements is the inclusion of risk management in crisis management. On the basis of this observation, the research problem was formulated: "In the light of new challenges, should the crisis management system continue to be built on the theory of crisis within the security sciences, or should it be based on risk management developed in the area of management sciences?" In summary, the answer to the question was provided, and a new definition of the concept of "crisis management" was proposed.

Keywords: crisis management, conditional risk, risk management capability, preparedness.

1 Introduction

In response to the growing number of natural disasters and those affected by them, the UN World Conference on Disaster Prevention and Reduction in its report ("Report on the World Conference on Disaster Reduction") adopted the "Hyogo Action Plan for 2005–2015" (Hyogo Framework for Action: 2005–2015). Under the plan, it was decided to improve disaster response capacity and to ensure coordination and international cooperation. In Poland, the focus was on building a crisis management system, strengthening the rescue services, and improving hydro and meteorological monitoring. At the end of the plan, the next UN Conference on Disaster Risk Reduction adopted a new strategic paper titled "The Sendai Framework for Disaster Risk Reduction 2015–2030." This time, the accent was put on the prevention of natural disasters based on risk assessment and management.

Building and maintaining security based on risk management is a typical business activity, primarily for the banking and insurance sector (Basel Committee on Banking Supervision). The academic foundation for the methods and practices involved in risk management is management science. For administration (including for crisis management), this approach is new. On this basis, a research problem has been formulated: "In the light of new challenges, should the crisis management system continue to be built on the theory of crisis within the security sciences, or should it be based on risk management developed in the area of management sciences?" To answer this question, it was necessary to answer two additional questions: "What steps are involved in the process of obtaining risk management capacity in public administration?" and "Do the basic concepts used in crisis management differ depending on whether we define them in terms of safety sciences or management sciences?"

During the research process, the crisis management system was treated as an organization. A particularly important area of its analysis were the functional and operative aspects. Among the empirical methods used, direct observation should be distinguished in the analysis, synthesis, and analogy among the theoretical methods.

2 Capability of risk management in public administration

The strategic documents adopted in the UN at the outset are not the only ones that relate to risk management. The European Parliament and the Council of the European Union in 2013 decided to modify the mechanism of the EU Civil Protection Mechanism (EUCPM) (EU Law L 347/924, art. 4) and the implementation of risk management capabilities in all the countries. As justified, the reason for the change is the fact of a continuous increase in the number of catastrophes and natural disasters.

The modified decision is directly applicable in all Member States, which means that no national implementation is required. One of the new tasks re-

sulting from the decision is the aforementioned obligation to achieve risk management capabilities. This is understood as "the ability of a Member State or its regions to reduce risk, adapt to risks or limit risks, in particular its effects and the likelihood of a disaster or disaster identified in a country or region conducted by that country or region" (EU OJ L 347/924, art.4, paragraph 8). Within this task, four essential tasks were defined.

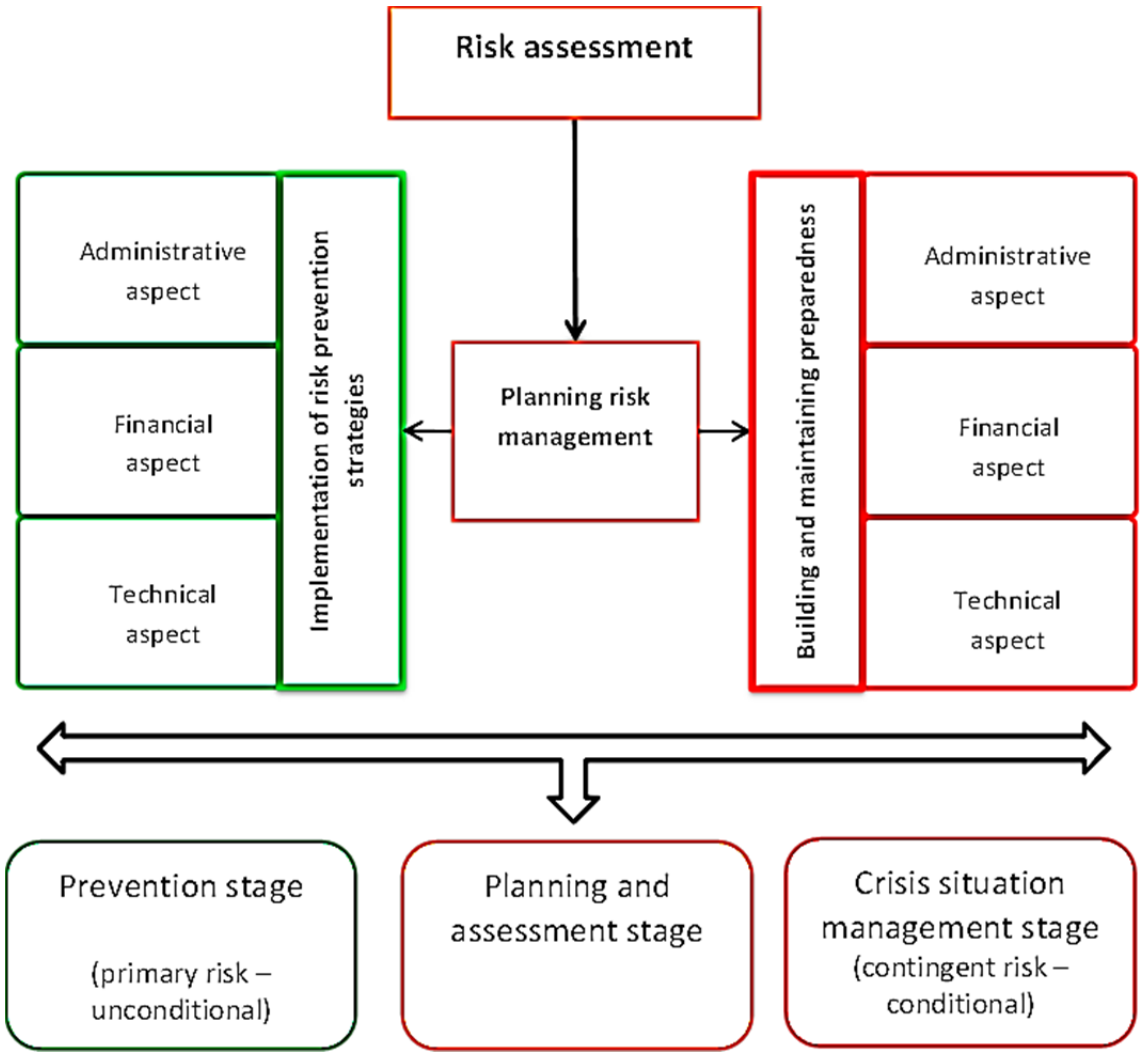

Figure 1. Stages of attaining risk management readiness
(*source:* own work)

These are:

- risk assessment,
- risk management planning,
- risk prevention, and
- ensuring readiness.

All steps of this process should be considered in terms of three aspects: financial, administrative, and technical. In interpreting these provisions, the sequence of necessary actions can be presented in the form of the Fig. 1.

Separation of the process for risk management readiness into two subprocesses linked to each other by the assessment and planning stage is justified.

Risk prevention involves unconditional risk[1]. Materialization of unconditional risk is a random event and is not subject to any other risks. Crisis prepared-

[1] For the sake of clarity, the term "primary risk" can be used because the definition of unconditional risk is often confused with a certain event, i.e., one whose probability of occurrence is 1.

ness refers, however, to contingent risk, which can only be considered if we assume that some earlier risk has materialized. Let's look at this example. Flooding is a natural hazard occurring randomly. Flood risk is a combination of the probability of floods and the expected losses. The risk of a crisis during floods is due to the contingent appearance of floods and the failure of systemic barriers (there are response structures, rescue systems, material resources, etc.) and supplement barriers (awareness raising for vulnerable communities, support for self-organization, etc.) (Skomra, 2015, pp.192-204).

These barriers are designed to prevent an adverse event (flood), as a result of the inadequacy of the forces and resources, from being transformed into a crisis. In functional-operative terms, the primary risk management for flood risk is mainly the task of the minister responsible for the environment and consists in reducing the probability of occurrence of the phenomenon and its direct consequences through proper water management, spatial planning etc. Contingency risk management is mainly within the competence of the Minister of the Interior and Administration, and consists in building systemic barriers and supplementary barriers.

Simplifying irrespective of the failures of the supplementary and systemic barriers, without a flood, the crisis situation associated with the flood will not arise. Of course, improving the effectiveness of barriers reduces the risk of a crisis but does not affect the number of floods. It is difficult, therefore, to include such activity in the prevention phase.

This division of unconditional and contingent risks can be referred to non-natural hazards. It is not always the case that the owner of the primary risk is public administration. This division becomes especially evident by analyzing the role of critical infrastructure. For example, for a water supply company, an unconditional risk is related to the potential failure and possibility of loss of income and the need to pay compensation for unrealized contracts. However, the contingent risk is the need to evacuate a hospital without a water supply. The owner of this second risk is not the water supplier, but the public administration.

3 Risk management in public crisis management

Comparing the steps required by the EUCPM to achieve risk management readiness with crisis management tasks, a number of common elements can be identified. The prerequisite for initiating the planning process for emergency management is the assessment of the dangers and the risks associated with them. The document in which such assessment is made is the National Security Danger Report (*Journal of Laws,* Dz. U. of 2013, item 1166, as amended, Article 5a). On the basis of the reports, crisis management plans are prepared (*Journal of Laws,* Dz. U. of 2013, item 1166, as amended, Article 5). These plans contain elements that allow for their implementation to be ready for all required aspects (technical, organizational, and financial). On the other hand, the law does not cover tasks related to primary risk prevention. No risk management plans are prepared, and no risk prevention measures are being prepared or implemented.

Many times in various government documents, the need to change this situation has been declared. For example, the Effective State Strategy 2020 states the following: “It is planned to develop, in accordance with the provisions of the EU Internal Security Strategy, a national strategy paper on risk management as well as forecasts (assessments) relating to the probability of terrorist and other attacks” (Effective State Strategy 2020, p.98).

One of the reasons why such a document has not been developed is the difficulty in identifying the necessary financial resources to fight particular threats. This concerns both the limited capacity of the state budget and the fear that the expenditure incurred will prove to be pointless. This is possible if the threat does not occur or its course is different than expected. To indicate how to solve this problem, we must note that in order to manage the financial risk in the first stage, we must recognize the probability distribution of each possible future situation based on historical data. In the case of financial outlays aimed at minimizing the future effects of an event involving forces of nature, we do not have such data. This is therefore an uncertain situation.

Although uncertainty is an immeasurable category, attempts are being made to rationalize decision-making taking into account the criteria used by the decision maker (Bochenek, 2012, pp.58-59). Depending on the expectations of the decision-maker, the following criteria can be applied:

1) Laplace criterion, i.e., the largest mathematical hope. Decision makers do not have information about the probability of possible states of nature, which means that each state is equally likely. Each variant of the action can be assigned the amount of the expected effect. The entity chooses and implements a variant that provides the highest level of gain, i.e., the largest mathematical hope.
2) Wald criterion, i.e., maximin. Of the possible variants, the trader chooses the one that ensures the best minimum. This means that from the set of the worst results, i.e., extreme disadvantages of nature, the decider chooses the most favorable result. The Wald criterion therefore includes the possibility of implementing the project in the least favorable circumstances.
3) Savage criterion, i.e., minimax. The assessment of the choice in this criterion concerns the effects of a wrong decision. The entity chooses that variant whose implementation attracts the smallest of maximum losses. The choice is therefore of the least dangerous undertaking.
4) Bayesian criterion, i.e., the expected value. Of the equally similar states of nature, the entity chooses the variant that provides the greatest expected value. The selected variant thus allows you to maximize production or other amount.
5) Hurwitz criterion, i.e., the indicator of optimism. The decision-maker takes into account both the best and the worst results in their activity. Taking into account their own preferences, the decision-maker expects optimistic and pessimistic situations. Applying a compromise strategy, the entity chooses either a maximax variant or a maximin variant.

To choose the right criterion, it is important to note that public administrations do not work for profit or optimize their activities on the basis of expected returns. For this reason, the savage criterion should be applied to its operation in uncertain situations. In practice, the use of this criterion is reduced to activities on the so-called matrix of regret (Jędrzejczyk, Skrzypek, Kukuła and Walkosz, 2012, pp.160-161). Adaptation of the matrix of regret for use by public administration was carried out within the framework of the "Risk Assessment Methodology for the Crisis Management System of the Republic of Poland" project (Project No. O ROB /0077/03/003) financed by the National Centre for Research and Development (Skomra, 2015, pp.170-173). Its use can be presented in the following example. We do not know if next winter will be severe or mild. Thus, we have the following options:

- the frosts will not be harsh enough for any action to be necessary,
- there will be frosts so strong that certain undertakings should be conducted to reduce their effects,
- there will be frosts that are relatively severe and they should be solidly prepared for,
- extreme frosts will occur, so risk reduction activities associated with them should be serious (expensive).

These four scenarios can be defined as follows. In the first case, it is "no risk," for the second case "low risk," for the third case "medium risk," and for the fourth case "high risk." However, in the case of other threats, it is better to use probabilities. For example, the probability that a certain number of people will contract an infectious disease. This may apply the following scale: very low probability, low, medium, or high.

The response to the expected threat may be as follows:

1) do nothing (routine work by the services, security and inspection is carried out);
2) small interventions (e.g., increasing the frequency of monitoring of hazards, enhancing the staffing of entities dealing with threats);
3) medium intervention (strengthening the readiness of subordinate forces and resources, halting holidays, concentration of at least some of the resources in the designated places, ensuring readiness to support other entities to carry out defined tasks);

4) large intervention means extraordinary means, which may affect the financial liquidity of an entity, e.g., related to the introduction of a state of emergency because of the insufficient nature of ordinary measures.

For each of these cases, we build a cost table, assuming that the average intervention should reduce the final loss by approximately 50% and a large loss by about 90% (the number of response types can be increased or decreased depending on the data held). When building a cost table, account should be taken of both the amount spent for minimizing future losses and the loss itself. The costs are presented directly in money. An example result is shown in Table 1.

Table 1. Example cost table in 1000 PLN with different variants of response for all possible risks (s*ource:* Bralewski, Piec and Wróbel, 2016, p.35)

ACTION	Size of threat			
	Very small	Small	Medium	Large
Do nothing	10	20	40	70
Small intervention	11	20	45	71
Average intervention	13	21	38	65
Large intervention	21	24	37	57

In the next step, the cost table is transformed into a matrix of regret. The transformation involves finding the lowest values of costs borne in each column and subtracting that value from the cost values defined in each cost table field. The resulting matrix is shown in Table 2.

Table 2. Matrix of regret (*source:* Bralewski, Piec, Wróbel, 2016, p.36)

ACTION	Size of threat			
	Very small	Small	Medium	Large
Do nothing	0	0	3	13
Small intervention	1	0	8	14
Average intervention	3	1	1	8
Large intervention	11	4	0	0

The next step is to choose from the prepared matrix of regret the value of the largest possible loss within the decision of a given type (the maximum value in each row).

The successive cost values are:

- for the strategy of "do nothing" – 13,
- for the "small intervention" strategy – 14,
- for the "average intervention" strategy – 8,
- for the "large intervention" strategy – 11.

Since our goal is to minimize losses in the event of an unsuccessful decision, we choose a value of 8 from the four cost values, which means that the op-

timum solution in this case is the “average intervention” response. This can be interpreted as follows. If we make the wrong decision, then the losses we will bear will still be the lowest possible. This is a good justification for decision-makers in the case of accusations of wasting tax money.

A further element of risk management, but this time associated with conditional risk, occurs at the stage of building and maintaining readiness. The very construction of a network of units to react to an unfavorable event requires a risk assessment. For example, the selection of equipment of the units of the State Fire Service is based on the assessment of hazards at the district level (*Journal of Laws* Dz. U. of 2014, item 1793, par. 2, pt. 2). It is planned that the further development of the National Rescue and Firefighting System will be based primarily on risk assessment (Wróblewski, 2016). However, even with the best prepared response system, events of such a scale may occur that it will suffer from insufficiency. For the risk assessment of this situation, a crisis matrix based on systemic and supplementary barriers (Skomra, 2015, pp.192-204) is used. The systemic barriers mentioned at the beginning of the article are barriers to the dangers of dynamic threats that create a system for protecting the community from threats (including, among others, the services, inspectorates, and guards). Supplementary barriers are barriers that limit or enhance the effects of dynamic threats, resulting from the sensitivity and resilience of a given community, and affecting the susceptibility of a population exposed to the threat. Susceptibility can be defined as exposure (vulnerability) to a threat to the community in relation to resilience. Susceptibility includes two elements: resilience and sensitivity. Resilience is related to risk management and the ability to reduce or cope with harm. Sensitivity is related to exposure to risk (...). The combination of sensitivity and resilience creates vulnerability to a specific threat (EMA, 1999; Lewis, 2014).

Sensitivity determines the ability of a given community to cope with the effects of an adverse event, such as experience gained previously that affects the behaviour of people at risk (e.g., older people and children are more sensitive to the threat than other people, etc.). Sensitivity is assessed for two effects: “people” and "property." Assessment is based on an estimation of how strongly a given barrier may weaken the performance of the systemic barriers on a scale of 0 to –10 where 0 means no influence and –10 maximum attenuation.

Sensitivity to the effects of “people” is assessed on the basis of barriers:

1) the average density of people living permanently in a potential danger zone;
2) the number of people temporarily residing in a potential danger zone;
3) the possibility of seasonal population growth;
4) location in the danger zone of hospitals, nursing homes, closed centers, schools, kindergartens, crèches;
5) physical fitness level of people in the danger zone (including the disabled, children, the elderly, the chronically ill);
6) location in the danger zone of sports facilities;
7) location in the danger zone of commercial facilities;
8) other (special, e.g., temporary meetings);
9) location in the danger zone of industrial plants.

Sensitivity to the effects of “property” is assessed on the basis of barriers:

1) national heritage sites including religious sites;
2) high-value sites;
3) existence of critical infrastructure sites;
4) cultivated fields and orchards;
5) buildings;
6) breeding and farming sites;
7) communication trails.

Susceptibility can strengthen or weaken systemic barriers. In the first case, there is a situation where the local community has the ability to cope with a dangerous situation even when professional emergency services fail.

In the second case, due to the characteristics of the local community, the effects of the dynamic threat are greater than those resulting from the risk analysis despite the correct response of the professional emergency services. Susceptibility thus affects sys-

temic barriers, and this effect results from the appearance of supplementary barriers.

Constructing a crisis risk matrix is based on the calculation of the crisis readiness index (W), based on sensitivity and resilience assessments in the "people" and "property" categories. The risk and crisis readiness values determine the severity of the crisis if it occurs. By putting the calculated crisis preparedness index and the risk level in a table, we obtain a matrix of the crisis situation. A template for such a matrix is shown in Fig. 2.

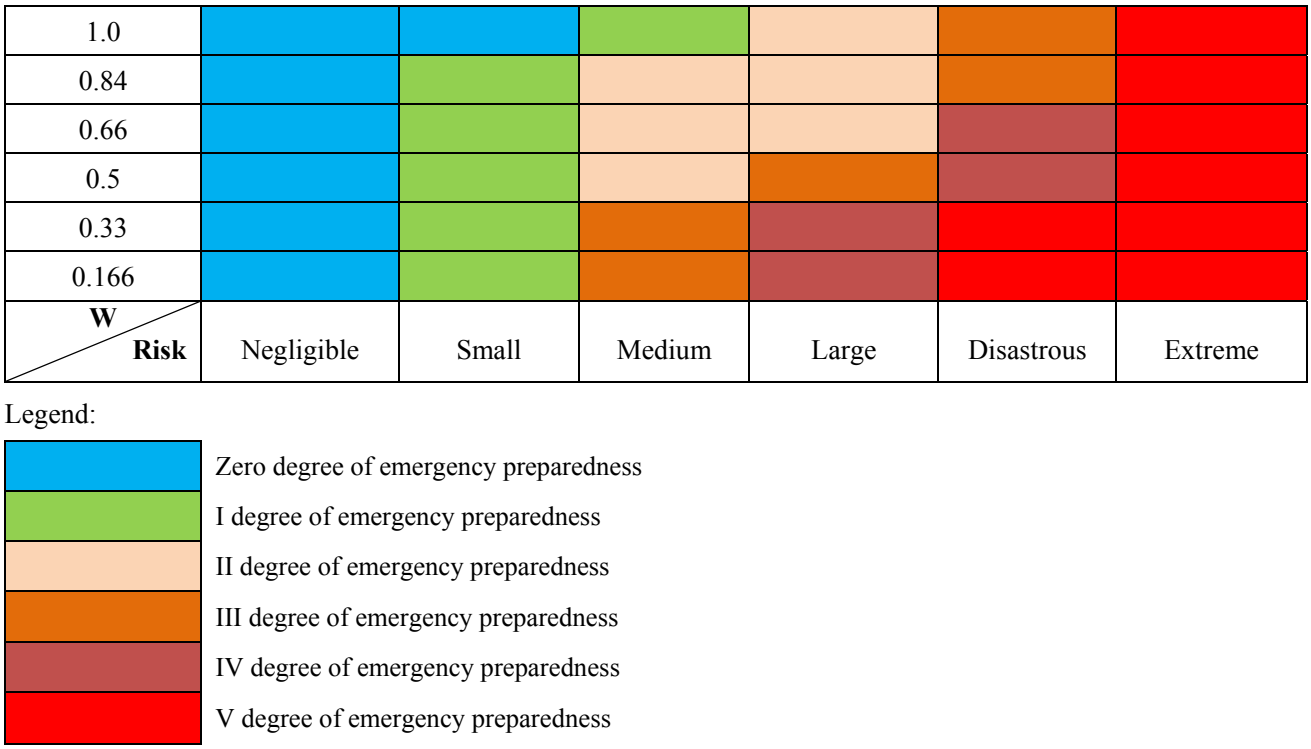

Figure 2. Pattern of risk matrix for a crisis situation
(*source:* Bralewski, Piec and Wróbel, 2016, p.28)

The crisis preparedness classes thus obtained mean:

1) Zero degree of emergency preparedness – due to the negligible risk of the scenario materializing, situations in this class are ignored (marginal importance for the development of the crisis).
2) I degree of emergency preparedness – the crisis situation is managed on a routine basis, its development is predictable, the probability of a social crisis is unlikely, there is a certain probability that it will evolve into a II degree of preparedness situation.
3) II degree of crisis preparedness – the emerging crisis requires support for supra-local resources, can trigger a local socio-political crisis. There is a possibility of becoming a III degree crisis situation.
4) III degree of crisis preparedness – the crisis situation requires central assistance, possible socio-political crisis, possibility of introducing a state of emergency in part of the territory, there is the possibility of becoming a IV degree of crisis preparedness.
5) IV degree of crisis preparedness – the crisis situation may cause a political and social crisis, as well as threaten national security, possible introduction of one of the states of emergency throughout the country.
6) V degree of crisis preparedness – the materialized hazard scenario was not previously included in the considerations of risk assessment. This means that the situation, regardless of the crisis level, "W" will always cause a crisis situation due

to lack of detailed information about the threat and absence of appropriate procedures.

Going to mathematical analysis, including game theory, to address the problem of primary and contingent risk management already indicates that crisis management should not continue to be seen only as a response to emergencies. In the new version, the crisis management system should include risk assessment, risk management, and response components when the risk materializes. This observation leads to another question: On what scientific grounds should the solutions needed to build a comprehensive crisis management system covering all the steps required by the EUCPM be sought?

4 Crisis management in terms of safety sciences and management sciences

Leaving crisis management understood as a capability to manage a crisis and moving to a comprehensive risk management model means a significant change for the administration. This also applies to the definitions and concepts used. The crisis management system is largely based on the definitions and approaches of the safety sciences, where it is based on risk assessment, but risk management is marginal. There is a need to standardize terminology in the implementation of crisis management tools developed on the basis of management science.

Critical concepts used in crisis management, apart from crisis management itself, are "crisis" and "crisis situation.". In both of these areas of science, the understanding these terms is diametrically opposite. Some examples:

- crisis in the subjective sense is the breaking of the existing system, consisting in changing its structure or function or both together (Wróblewski, 1996, p.9),
- we will call a crisis the culminating phase of escalation of the threat, often with total loss of control over the existing crisis situation, in which there is a breakthrough (turning point) of a process whereby a given object can be decommissioned, destroyed or restored to normalcy and even development (Marszałek, Sobolewski and Majchrzak, 2012, p.31).

The same concept is presented in another context in management science:

- a crisis is a condition that threatens the company's survival, its goals, limits the time available to take remedial action, and surprises its decision-makers with its appearance, thus creating conditions of strong pressure (Herman, 1963),
- crisis – an abnormal and unstable situation that jeopardizes strategic goals, an organization's reputation or its resilience (BS 11200:2014, p.2).

A comparison of the two approaches to the term "crisis" is presented in Table 1.

Table 1. Comparing the definition of crisis from different perspectives (*source:* own work)

	Duration	Manageability
Security science	Breakthrough, turning point, moment	Loss of ability to manage the situation
Management science	State, phase, period, situation	Required management under time pressure

Analogous discrepancies also apply to other concepts. For example, a crisis situation is interpreted as follows:

- crisis situation – a set of external and internal circumstances in which a given entity (system, organization, system) is located, influencing its functioning in such a way that it starts and continues to process, resulting in imbalance and loss of control over the course of events or escalation of the threat to its interests (Gryz and Kitler, 2007, p.22),
- crisis situation in an organization – its condition resulting from the development of certain unfavorable phenomena in time that does not give rise

to a direct threat to the existence of the organization, but indicates an unsatisfactory assessment of its activities from the perspective of changes in the environment and/or relation to the model state (Kral, Zabłocka-Kluczka, 2003, p.20).

A comparison of the concept of "crisis situation" from the viewpoint of security sciences and management sciences is presented in Table 2.

Table 2. Comparison of the concept of "crisis situation" from different perspectives (*source:* own work)

	Essential elements of the definition	Manageability
Security science	Process leading to loss of control over the situation (pre-crisis phase)	It requires extraordinary actions (extraordinary legal and organizational arrangements, such as the introduction of a state of emergency)
Management science	Unsatisfactory state of the organization	Required implementation of the management process under time pressure

However, the differences in interpretation of the concept of "crisis management" are most important. According to security science its definition may look like this:

- *crisis management* in the field of security is "activity of a variety of means (including diplomatic, special, economic, military, normative) and resources (human, financial, material and intellectual) undertaken in anticipation or in the event of difficult, critical, in a word, disrupting the functioning of the international environment and violating the process of economic and social development, but also human rights, public order and international order (internal), natural balance, etc." (Kitler, 2011, p.18),
- the same concept in the standard titled crisis management – guidelines and best practices is defined as follows: crisis management is the development and use of the organization's ability to cope with a crisis (BS 11200: 2014, p.2).

A comparison of the concept of "crisis management" in terms of security sciences and management sciences is presented in Table 3.

Table 3. Comparison of the concept of "crisis" from different perspectives (*source*: own work)

	Essential elements of the definition	Approach to management
Security science	Actions taken in anticipation or in the event of difficult, critical situations	Discrete (discontinuous)
Management science	Constant building and maintaining the organization's capacity to cope with crises	Process

As can be seen from this analysis, crisis management in the context of the security sciences is linked to taking incidental emergency action in dangerous situations. For management sciences, crisis management is a continuous process of achieving and maintaining the capacity of an organization (state, system) to deal with cases when the organization's status becomes "unsatisfactory." And that's exactly the approach that corresponds to the EUCPM provisions.

At the same time, given that a crisis situation concerns the organization that is public administration or a state as a whole, operational risk management may be useful for defining crisis management. This seeks to dominate the triad of risk–safety–continuity (Zawiła-Niedźwiecki, 2013, p.57), which

translates into risk management, security management, and business continuity management. All these issues relate to the existing structure and processes implemented by this structure. In addition, in order to ensure business continuity, additional structures supporting the basic structure are envisaged.

To encourage the use of the management sciences in risk management, a number of EU documents boost this. For example, the EU directive on measures for a high common level of network and information security – the NIS directive (EU L 194/1 of July 19, 2016), which refers to operational risk management, and assumes a procedural approach to providing services by public administrations.

In turn, the European Commission documents "The Risk Management Guidelines" (EU Directive 2015/C 261/03) refers to the standard, Risk Management – Principles and Guidelines (PN-ISO 31000:2012) and the EFQM Excellence Model. The EFQM model embraces the eight principles of excellence. One of these is management through processes (Kosieradzka, Zawiła-Niedźwiecki, 2016, pp.92-97). The process approach to providing services to the population is also shown in the national normative documents, although for the time being, this only applies to services based on telecommunications infrastructure (*Journal of Laws* of 2012 Dz. U., item 526).

5 Conclusions

According to the current law, crisis management is the activity of public administration bodies, which is part of national security management, whose responsibility is to prevent crisis situations, preparations to take control over them with planned actions, respond to emergencies, remove their effects, and restore resources and critical infrastructure (*Journal of Laws* of 2013 Dz. U. item 1166 as amended, article 2).

The inclusion in these tasks of risk management system is not a simple operation. It is necessary to reanalyze the phases of action and related tasks. As a result, the task of the system, which today is aimed at a direct response to the anticipated or existing crisis, should be extended to include a prevention phase. The purpose of the modified system should be primary risk management, while at the same time building and maintaining the resources and structures necessary to respond to emergencies.

These activities should be treated as a continuous, routine administrative action understood as a process. In order not to make mistakes when extending the system to new functions and activities, it is necessary to use solutions scientifically developed and verified in practice. In the management sciences, such a verified solution is the management of operational risk. However, basing the system of crisis management system requires changes in the basic concepts defining the system.

Including the definition of crisis management alone, which should read as follows: "Crisis management is the activity of public administrative bodies which is a component of national security management, which consists in identifying risks, managing threats and managing crisis situations, including those caused by critical infrastructure disruption."

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