Handreiking
Regionaal
Risicoprofiel

Regional Risk Assessment in The Netherlands

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Contents

1. Introduction

From 2011 onwards, in The Netherlands the 25 so-called Safety Regions (see below) are by law required to develop a regional risk assessment, also referred to as 'regional risk profile'. To assist the regions in this endeavor and realize a common practice and understanding, in 2009 a 'National Guideline on Regional Risk Assessment' has been developed, as a joint initiative of the Dutch Association for Fire fighting and Disaster management, the Dutch Association for Medical Emergency Management, the Council of Chief Constables and the Council of Municipal Disaster Management, in close cooperation with the Ministry of the Interior and Kingdom Relations and experts from nearly all Dutch Safety Regions. In this guideline is described how the regions can identify hazards, analyze them, and support the process of political decision making on risk management policies. 24 of the 25 regions have decided to implement this guideline, enabling a comparison between the regional risk assessments. Moreover, to ensure a close connection between the regional assessments and the national risk assessments, the method as described in the national guideline is based upon the method used by the Dutch central government. This method is scientifically sound, and consists of a combination of tried and tested sub-methods on the one hand, and new elements on the other, developed to meet the requirements (including uniformity and comparability) of national and regional risk assessment in The Netherlands.

This paper gives an outline of the 'Dutch approach to risk assessment'. Firstly in chapter 2 the organization of the Dutch government is described, for a better understanding of the Dutch approach. This is followed by a description of the underlying reasons to implement a regional risk assessment in chapter 3. In chapter 4 the interpretation of the concept of risk is presented, followed by a description of the process for risk assessment and policy making in chapter 5. In chapters 6 to 8 the distinct steps of the risk assessment are presented, namely hazard identification, risk analysis and risk evaluation. Chapter 9 then concentrates on the translation from the risk assessment into concrete risk management policies. Concluding this essay, in the epilogue a vista is given upon the usability of the Dutch approach for the MiSRaR project.

2. Organization of public safety and security in The Netherlands

The Dutch constitution distinguishes 3 government levels: the central government, the provinces and the municipalities. The central government consists of the parliament and the cabinet, headed by the prime minister. The cabinet is assisted by 13 ministries which are responsible for the preparation of legislation. Concerning safety and security the responsibility of the central government is limited to *national* issues. The national coordination is primarily dedicated to the Ministry of the Interior and Kingdom Relations and ultimately to the prime minister's office. For specific issues the Ministry of the Interior cooperates with several other ministries, such as the Ministry of Justice, Ministry of Housing, Spatial Planning and the Environment, Ministry of Transport, Public Works and Water Management, Ministry of Health, Welfare and Sport, Ministry of Agriculture, Nature and Food Quality and the Ministry of Defense.

However, the main responsibility for safety and security, and risk management policies, is dedicated to the so-called 'de-centralized governments': primarily to the 430 municipalities and secondary to the 12 provinces. The municipalities are responsible for fire fighting, police and security, risk management and disaster preparedness. The provinces are responsible for risk policies only concerning issues that transcend the level of the municipalities.

While the formal responsibilities for safety and security are mainly concentrated in the 430 municipalities, effectively the main government authorities for safety and security

are, however, organized on the level of 25 regions. Formally the Dutch constitution does not recognize these 'regions' as a fourth government level, separate from the central, provincial and municipal governments. However, to ensure that safety en security policies are corresponding between municipalities, instead of depending on the coordinating role of the 12 provinces, by law the 430 municipalities are clustered into 25 Police Regions (since 1993) and 25 corresponding Safety Regions (since 2010). The mayors of the municipalities within these 25 regions together are the management of the Police and the Safety Regions. This ensures that these supra-municipal regions execute the policies the municipalities demand.

The 25 newly formed Safety Regions are, on behalf of the municipalities, responsible for the fire services, the medical emergency management, the joint emergency room of police, fire services and ambulance services (112), and the disaster preparedness and response. Furthermore the Safety Regions give advice to the municipalities and provinces on risk reduction policies. Implementation of risk reduction policies, however, effectively remains a responsibility of the municipalities and provinces itself.

Furthermore, The Netherlands is divided into 26 Regional Water Authorities, the eldest form of Dutch government administration, because of the significant risk of flooding. They are responsible for the management of water barriers, water ways, water quantity (ensuring a correct water level) and water quality. The borders of the 26 Regional Water Authorities follow the dimensions of the water risk areas (water basins). This means they are completely different from the borders of the 25 Safety Regions.

3. Objectives of the regional risk assessment

Effective safety and security policies require insight in the actual risks that threaten society. By law the Dutch Safety Regions are therefore required to develop a 'regional risk profile'. This profile, or risk assessment, forms the basis for the regional risk management and disaster preparedness 'policy plans' of the Safety Regions. This means the main objective of the risk assessment is to enable local politicians to make *strategic* decisions upon the policy priorities of the Safety Regions. In other words: which risks are deemed most important by the local government to invest the limited time and resources of the Safety Regions upon? This means the risk profiles enable the municipalities to directly influence the policies of the Safety Regions on the basis of real insight in the actual risks.

A secondary objective of the risk assessments is to provide the Dutch people insight in the risks that threaten them. By means of the representation of the identified hazards on a 'digital risk map' on the internet, all inhabitants can gain insight in the industries, infrastructures, natural risks and so on, in their neighborhood.

Finally, the third objective is to professionalize the network management capabilities of the Safety Regions. To effectively address the risks within their borders, the Safety Regions need to cooperate with various kinds of public and private partners, including the Police Regions, Regional Water Authorities, public services and industries. By jointly developing the risk profiles with all the relevant public and private partners, the regions are enabled to reach agreement with them on joint risk management policies and together work in the same direction on risk reduction and disaster preparedness.

4. The concept of 'risk'

The United Nations defines risk assessment or analysis generically as a method for determining the nature and extent of risk "by analysing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend."[1]

The main objectives of risk assessment, described in chapter 3, require the method for risk assessment to enable a *ranking* of risks. Only on the basis of this ranking, in combination with political preferences, strategic choices on the risk policies can be made. The Dutch method offers the ingredients to rank risks from a multi-disciplinary perspective, leaving scope for administrative input about what is considered important and for other aspects of policy judgement.

The concept of 'risk' is defined as "a composition of the 'impact' (total of the consequences) and 'probability' or likelihood (a forecast about the occurrence) of a disaster or crisis". This means the ranking of risks has to consist of these two separate dimensions. The traditional formula of 'risk is probability times impact'[2] is deliberately avoided, because this tends to suggest a strictly quantitative interpretation. It would reduce 'risk' to a single number which in fact conceals the two fundamentally separate dimensions. In risk assessment impact and probability cannot be interchangeable, because they are not always weighed equally. Depending on the political agenda and the risk consciousness of the inhabitants either the impact or the probability can have a deciding influence on the policy priorities.

For example, in the Netherlands traditionally floods (from rivers and the sea) have had much attention. As a result the probability of floods is very low, because the safety measures have a calculated failure risk of once in a thousand or ten thousand years. The impact, however, of such an occurrence remains very high, resulting in continual attention from policymakers for this particular kind of risk. On the other hand power failures have a far greater occurrence, but mainly a lesser impact than floods, in this case leading to far less attention from policymakers. Shifting political preferences could, however, in the future lead to a reversal of the opinions on the risks in this example. For example, when the economical cost of a long-term power disruption are taken into account, policymakers might want to give this risk more attention as opposed to lowering the attention for floods.

5. The process for risk assessment and policy making

To make the Dutch method understandable for politicians and policy makers it is summarized in the following 6 questions. Because the 'regional risk profile' is by law directly interconnected with the 'policy plan', the Dutch approach consists of both risk assessment and policy making.

<u>Risk assessment</u>
1. Which hazards threaten our community? (hazard identification, chapter 6)
2. How serious are these threats? (risk analysis, chapter 7)
3. How important are they to the political decision makers? (risk evaluation, chapter 8)

<u>From risk assessment to policy making</u>
4. What are we already doing about the risks? (capability identification, chapter 9)
5. What more can we do? (capability analysis, chapter 9)
6. What more do we want to do? (setting objectives, chapter 9)

These steps are described in the following chapters.

6. Hazard identification

Hazard identification is the starting point for any risk assessment. It concerns the identification of the natural, technological and manmade hazards that can affect our region or municipality.

All hazard
The starting point of the Dutch approach is that in analyzing safety and security risks all kinds of hazards have to be taken into account. In the Netherlands the width of an *all hazard* analysis contains issues ranging from natural disasters (like floods, extreme weather and earthquakes), to technological driven disasters with hazardous materials (like explosions, toxic fumes) or transport (like planes, trains, pipelines) and ultimately also man-made disasters like terrorism. Moreover an all hazard approach brings together all these kinds of 'classical' disasters with 'modern' crises like long-term failures of utility supplies, political instability, polarization of populations and health crises like the flu pandemic.

To be able to compare totally different risks in an all hazard approach, as a basis for strategic policy choices, some sort of 'yardstick' is needed: a predefined model that makes it possible to measure risks in a comparable manner. In order to compare the completely different kinds of risks, that 'yardstick' needs to distinguish between the different sorts of consequences. In terms of the before described definition of a 'hazardous situation', the impact analysis needs to distinguish between the various kinds of consequences for the 'recipients' of a risk. The method for impact analysis therefore needs to recognize the different sorts of impacts of a disaster or crisis. In The Netherlands these different sorts of impacts are clustered in six so-called 'vital interests of the society' (see chapter 6).

The concept of a 'hazardous situation'
In the Dutch approach a hazardous situation consists of two components. Firstly a 'source' with an inherent risk of the occurrence of a disastrous incident, like for example industries, transportation and natural disasters. The other component defining a 'hazardous situation' are the 'recipients' or, in the terminology of the United Nations, 'conditions of vulnerability', that bare the consequences of a disastrous incident, like inhabitants, housing, cultural heritage and the environment. Only the combination of 'source' and 'recipient' make a hazardous situation. For example, an industry with toxic materials will only lead to a considerable risk if there are people living or working nearby. This definition of hazardous situations in itself presents a possible solution for risks: separating the source from the recipient, in other words *mitigation*.

Types of disasters and crises
Based upon the concept of 'all hazard' for The Netherlands the following 25 different types of disasters and crises are defined (see table on next page). This does not include volcanic eruptions and landslides, because they cannot take place in The Netherlands.

Risk inventory
Based upon the 25 types of disasters and crises the Safety Regions make an inventory of all 'hazardous situations'. The municipalities and provinces are by law required to provide data on all relevant industries, buildings and infrastructures. In the future possibly also cultural heritage will be added, as an extra vital interest of society. These data are presented on the so-called 'provincial risk map', a digital database which is accessible from the internet (www.risicokaart.nl). The Safety Regions use this system to generate maps for every type of disaster or crisis with a geographical component. Because hazards are not limited to manmade borders, the Safety Regions jointly analyze risks that are 'border crossing'.

Currently the provinces are examining the possibilities for automatically analyzing the correspondence between risk sources and risk recipients. For example, with the risk database lists could be made of households and public services within the hazardous zone of chemical industries, or within potential flood zones. Thus the Safety Regions gain insight in the overall nature of hazardous situations on their territory. Moreover in the phase of actual mitigation these data can be used to identify specific locations where risk reduction policies could be effective.

The central government givers extra attention to security risks like terrorism. Some vital infrastructures and public services that are specifically susceptible to security threats, are not presented on the public risk maps on the internet.

Type of hazard	Type of disaster/crisis
1. Natural environment	1.1 Floods
	1.2 Wildfires
	1.3 Extreme weather
	1.4 Earthquakes
	1.5 Pests
	1.6 Animal diseases
2. Buildings	2.1 Fires in vulnerable buildings
	2.2 Collapse of buildings
3. Technological risks	3.1 Incident with flammable or explosive substances
	3.2 Incident with toxic substances
	3.3 Nuclear incidents
4. Public services	4.1 Disruption of power supply
	4.2 Disruption of drinking water supply
	4.3 Disruption of sewage handling
	4.4 Disruption of telecommunications and ICT
	4.5 Disruption of waste handling
	4.6 Disruption of food supply
5. Transport	5.1 Plane crash
	5.2 Shipping disaster
	5.3 Traffic incidents
	5.4 Incidents in tunnels
6. Public health	6.1 Threats to the public health
	6.2 Pandemic outbreaks
7. Social environment	7.1 Panic in crowds
	7.2 Public disorder

Future risks
The risk inventory provides insight in the current risks. However, in the near or more distant future these risks might change. New hazardous situations may occur, or even new types of hazards can develop. Therefore it is important for the Safety Regions to explore the foreseeable risks in the future. Examples are new industries, housing projects near existing risks, new infrastructure, environmental changes and demographical changes like aging of the population. Especially global warming is a long term development that has to be taken into account because of the potentially enormous impact on the risks of floods, extreme weather conditions, public services like energy and water supply and maybe even (international) social unrest.

7. Risk analysis

The second step in risk assessment is the actual risk analysis. In the Dutch approach the risk analysis constitutes a analysis of disaster and crisis scenarios on the two dimensions of risk: impact (or vulnerability) and probability.

Scenario analysis
Insight in actual and future hazardous situations does not automatically translate into a risk analysis. It is impossible to try to separately analyze the hundreds or even thousands indentified hazardous situations. In the Dutch approach this is considered not only impossible, but even useless, because the risk assessment needs to be directed to strategic policy making. In order to enable politicians to choose between strategic policy options rather than concrete measures for individual hazards, it is important to abstract the hazard identification to a strategic level. The Dutch method for risk assessment therefore

presupposes that threats to the safety and security are described in *scenarios*. Dutch risk analysis in fact is an example of *scenario analysis*.

In international literature the accepted definition by Wilkinson states a scenario is "a tool for ordering one's perceptions about alternative future environments in which today's decisions might be played out."[3] For the use of scenarios in risk assessment the more precise Dutch definition is as follows: "a scenario is the expected development of a disaster or crisis, described in terms of principle causes, concrete triggers and the final consequences for the vital interests of society".

The main reason for the use of scenarios as an instrument for risk assessment is the possibility to define the critical elements in the development of a disaster or crisis, as a basing for strategic policies. A scenario analysis enables the identification of the most important factors with which the outcome of a disaster or crisis can be influenced positively. This means in one case risk reduction (meaning either reduction of the impact or of the probability) needs the most attention, while in another case disaster preparedness is most important. The risk assessment therefore enables a tight correlation between risk management and disaster preparedness.

To enable a scenario analysis the identified hazards have to be described in terms of potential disaster or crisis scenarios. For every of the 25 types of disasters and crises the experts of the Safety Regions have to determine which scenarios could realistically occur on their territory. This is called the first 'funnel': from many hazardous situations to a limited number of scenarios.

The actual method for analyzing scenarios corresponds directly with the before mentioned two dimensions of risks: impact and probability. In the following sections the method for impact and probability analysis is described.

Impact analysis
Impact is defined as "the total of the consequences of a risk scenario". Because the risk assessment consists of an all hazard approach, various kinds of consequences have to be taken into account. For example, an explosion has consequences which are completely different from the pandemic outbreak of flu or social unrest. When one wants to compare the impact of such different scenarios a multi criteria analysis is needed. The Dutch all hazard approach to measuring the consequences of risk scenarios is therefore based upon the principle of so-called 'vital interests': in the impact analysis those consequences are taken into account which inflict direct damage to the vital interests of society. In The Netherlands for the regional risk assessment the following six vital interests are defined, of which the first five are also used for the national risk assessment. Each of these vital interests is measured by means of 1 to 3 criteria. For methodological reasons the total of impact criteria is set on ten.

Vital interest	Criteria
1. Territorial security	1.1 Infringement of the territorial integrity
2. Physical safety (public health)	2.1 Number of fatalities
	2.2 Number of seriously injured & chronically ill
	2.3 Physical suffering
3. Economic security	3.1 Financial costs
4. Ecological security	4.1 Long-term damage to flora & fauna
5. Social and political stability	5.1 Disruption to everyday life
	5.2 Violation of the democratic system
	5.3 Social psychological impact: public (out) rage and anxiety
6. Safety of cultural heritage	6.1 Damage to cultural heritage

For each of the ten criteria, the impact is rendered measurable by using five categories: A – B – C – D – E.

These are classified as follows:

A	Limited consequences
B	Substantial consequences
C	Serious consequences
D	Very serious consequences
E	Catastrophic consequences

Each category for each criterion is characterized by a range. For example, for fatalities the number for E (catastrophic) is set on 400 deaths or more, while for financial costs the category E means a total cost of 2 billion or more.

Hereafter the 6 vital interests and 10 criteria are defined.

1. Territorial security
Territorial security is defined as the actual or functional loss of use of parts of the Dutch territory. Functional loss is mainly deemed to mean the loss of the use of buildings, homes, infrastructures and land. Examples of potential threat triggers are: rivers bursting their banks, terrorist attacks, secession of a region, outbreak of animal disease, attack by a foreign power and chemical, biological or nuclear contamination.

The following are used as indicators for measuring the impact of an infringement of the territorial integrity:
- the area of the territory at risk or affected (geographical demarcation);
- the period of time for which the region is at risk or affected;
- the population density of the region concerned.

Impact scores criterion 1.1 territorial loss

area → time ↓	District/village max 4 km2	Locally 4-40 km2	Municipal 40-400 km2	Regional >400 km2
2-6 days	A	A	B	C
1-4 weeks	A	B	C	D
1 tot 6 months	B	C	D	E
½ year or longer	C	D	E	E

2. Physical safety (or public health)
Physical safety is defined as the disruption of the functioning of the people of the Netherlands. The impact is measured by means of 3 criteria:
- fatal injuries, immediate or premature death within a period of 20 years;
- seriously injured and chronically ill;
- physical suffering in terms of lack of basic necessities of life.

Impact scores criterion 2.1 fatal injuries

number → time ↓	1	2-4	4-16	16-40	40-160	160-400	> 400
Direct death (within 1 year)	A	B	C	C high	D	D high	E
Early death (1 to 20 years)	A	A	B	C	C high	D	D high

Impact scores criterion 2.2 seriously injured and chronically ill

number → time ↓	1	2-4	4-16	16-40	40-160	160-400	> 400
	A	B	C	C high	D	D high	E

Impact scores criterion 2.3 physical suffering in terms of lack of basic necessities of life

aantal → time ↓	< 400 affected	< 4.000 affected	< 40.000 affected	> 40.000 affected
2-6 days	A	B	C	D
1-4 weeks	B	C	D	E
1 month or longer	C	D	E	E

3. Economic security

Economic security is defined as the undisrupted functioning of the Netherlands as an effective and efficient economy. It is measured by means of 1 criterion: amount of euro's in terms of repair costs for damage sustained, extra costs and loss of income.

Impact scores criterion 3.1 economical cost

Costs in €	< 2 million	< 20 million	<200 million	<2 billion	> 2 billion
	A	B	C	D	E

4. Ecological security

Ecological security is defined as the undisturbed continued existence of the natural environment in and around the Netherlands. This is measured by the long-term impact on the environment and on nature (flora and fauna) in terms of harm to designated wildlife and scenery conservation areas, and harm to the environment in the broad sense.

Impact scores criterion 4.1 environmental damage

(average) relative surface → type of nature ↓	**<3%**	**3-10%**	**>10%**
Nesting area meadow birds	A	B	C
Ecological Main Structure	B	C	D
Natura 2000	C	D	E

5. Social and political stability

Social and political stability is defined as the undisrupted continuing existence of a social climate in which individuals can function undisturbed and groups of people can live together peacefully within the framework of the Dutch democratic constitutional state and shared values. The impact is measured by means of 3 criteria:

- disruption to everyday life;
- violation of the local and regional democratic system;
- social psychological impact: public (out) rage and anxiety.

Impact scores criterion 5.1 disruption to everyday life

aantal → time ↓	< 400 affected	< 4.000 affected	< 40.000 affected	> 40.000 affected
1-2 days	A	A	B	C
3 days to 1 week	A	B	C	D
1 week to 1 month	B	C	D	E
1 month or longer	C	D	E	E

Criterion 5.2 and 5.3 are left out in this essay, because they too much explanation is needed.

6. Safety of cultural heritage
Finally, for the regional risk assessments the safety of cultural heritage has been added to the method for national risk assessment. This is defined as the undisturbed continued existence of the physical remains of the past that are valued by society because of collective memories, national identity, scientific research and/or education of future generations. The value of cultural heritage is explicitly separated from the commercial value. The value instead is measured in terms of uniqueness, loss of national identity, limited possibilities for restoration and importance as source for science and education.

Impact scores criterion 6.1 damage to cultural heritage

Number of indicators →	max. 1 indicator	max. 2 indicators	max. 3 indicators	4 indicators or more
	A	B	C	D

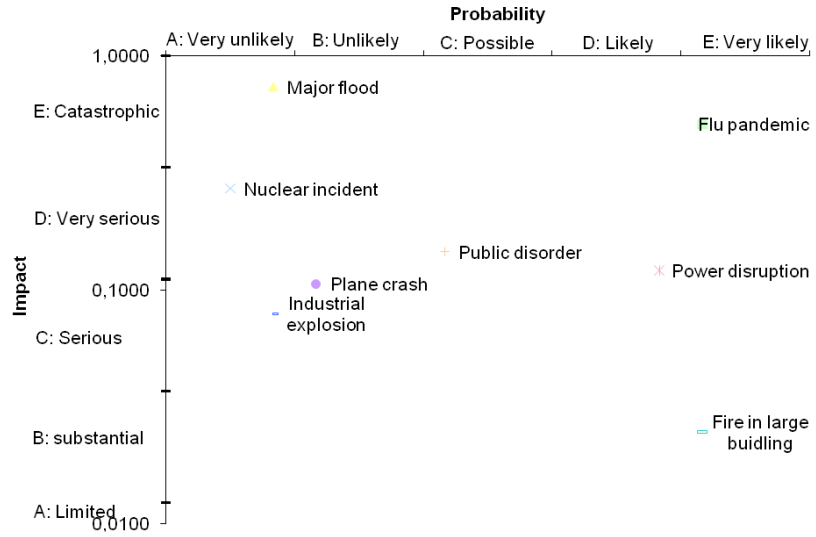
Probability analysis
Probability or likelihood is defined as "a forecast about the occurrence of a risk scenario". In other words: how often is the risk scenario expected to occur. To determine likelihood, a breakdown into five categories is used (categories A-E). The classification matches the principles chosen to determine impact. Category A represents an incident scenario that is deemed very unlikely, while Category E represents an incident scenario that is deemed very likely:

A	Very unlikely	0.005	- 0.05%
B	Unlikely	0.05	- 0.5%
C	Possible	0.5	- 5%
D	Likely	5	- 50%
E	Very likely	50	- 100%

If possible the probability is measured quantitatively (% chance of occurrence in the next 4 years), if not it is estimated qualitatively.

The risk diagram
The outcome of the impact and probability analysis is presented in a so-called 'risk diagram'. This diagram consists of a X axis with the categories A to E for probability and an Y axis with the categories A to E for impact.

Figure: fictional example of a risk diagram



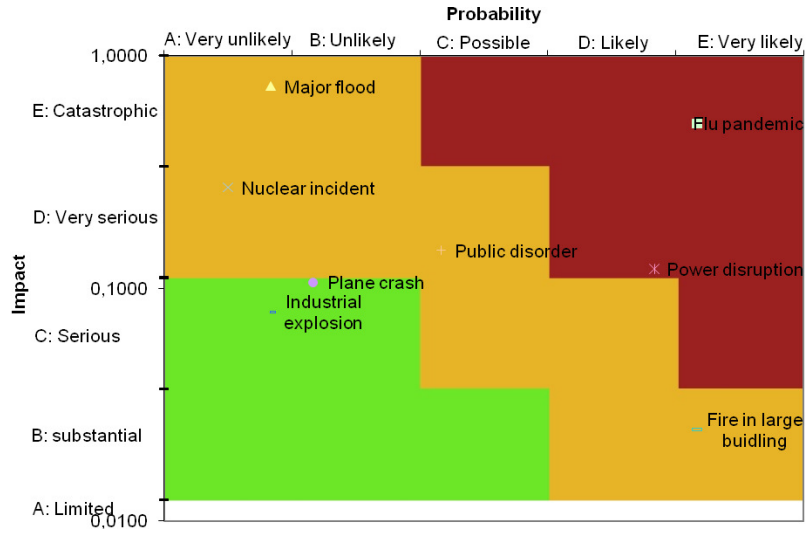
The risk diagram is generated by means of specially developed calculation module in Office excel. This program merges the ten individual impact scores into a final aggregated score per scenario and then combines this in a diagram with the probability score.

8. Risk evaluation

The risk analysis, based upon the hazard identification, leads to insight in the objective 'ranking' of risks. When the hazards are identified and the risks are analyzed, the results are presented to the political decision makers. The final step in risk assessment is to determine the significance of the analyzed risks for those who are affected. This step puts the objective analysis within the framework of the subjective political opinions. In this stage of so-called 'risk evaluation' the decisions are made about the priorities in the risk policies.

Interpretation of the risk diagram
In the Dutch approach the first step in risk evaluation is to present the risk diagram in a manner that enables better understanding and interpretation. This means categorizing the plotted risk scenarios in different priorities. In the figure below an example is given of a possible interpretation.

Figure: fictional example of a risk diagram interpretation



In this example the categories of impact and probability are presented in different colors that represent an ascending priority. The scenarios with both high impact and high probability (above right) are depicted in red, while the scenarios with low scores (beneath left) are depicted in green. The scenarios in between are orange. Such a depiction of the risk diagram enables politicians to better understand the risk analysis and thus enable the decision making process on policy priorities. In this fictional example 'flu pandemic' clearly demands the most attention.

However, there are more possible color representations of the risk diagram. For example some politicians expectedly would like to extend the red section to the hole range of 'catastrophic' scenarios, thus extending it to 'above left'. Disasters which could be catastrophic in consequence simply have more political attention, even if they are very unlikely to occur.

Political preferences
In order to facilitate a transparent political decision making process, in The Netherlands the Safety Regions are by law required to present the risk assessment to all municipal councils. The can make suggestions on the prioritization of risks and desired risk policies. In the end the mayors, in their role of management of the Safety Regions, decide upon the actual policies.

This process of political decision making is different in every country, but at the same time shows many similarities. It is important for the safety and security professionals to allow the political authorities to define their own set of preferences with which they decide on the future risk policies. Political decision making is more about subjective preferences than objective risk diagrams. These preferences could include factors like:
- public risk awareness and concerns of inhabitants
- existing policy priorities and political programs
- instructions from higher government levels
- prestigious projects (like new housing or industries)
- a disbalance between the risk level and the actual disaster preparedness.

In this first stage of political consultation, the main question is: which of the analyzed risks demand more attention? This phase therefore is about strategic priorities, rather than elaborate policy options. In the Dutch approach this is called the second 'funnel': from a wide scope of analyzed scenarios to a limited set of priority risks. These priorities are the basis for further research into concrete policy options.

9. From risk assessment to policy making

Having concluded the process of actual risk assessment, the next step is to define risk related policy options. Like mentioned before, this phase needs to address three questions:
- What are we already doing about the risks? (capability identification)
- What more can we do? (capability analysis)
- What more do we want to do? (setting objectives)

Capability is a very broad term, which (in the Dutch interpretation) stands for all possible factors with which the final outcome of disasters and crises can be influenced positively. This varies from mitigation policies to prevent and constrain the possible impact and decrease the probability, to policies to improve disaster preparedness. A (non exhaustive) summary of the suggested capabilities is given below.

Risk management
- Risk awareness of inhabitants, corporations and politicians
- Mitigation of hazardous situations (separation of risk source and risk recipient)
- Reduction of probability (making industries inherently safe)
- Prevention of consequences (preventive measures to minimize the consequences)

Disaster preparedness and response
- Contingency planning
- Quantity and quality (competence) of disaster relief personnel
- Quantity and quality of disaster relief materials
- Command and control
- Information management

Recovery
- Interconnection between disaster relief and recovery

As mentioned before, the concept of a scenario analysis enables a better understanding of capabilities. To be able to identify the capabilities that influence a risk the most, it is necessary to analyze the developed priority scenarios once more. For every aspect of the scenario (causes, triggers, consequences) solutions can be identified. Of those the most important are chosen.

In order to finally set the objectives a cost-benefit analysis can be performed on the indentified measures. On the other hand, political decisions on concrete policy measures are governed by political preferences, just like the prioritization of risk scenarios. A cost-benefit analysis cannot always provide all the decisive answers.

10. Epilogue: usability of the Dutch approach for the MiSRaR project

In conclusion it is obvious that the Dutch approach shows similarities with the seminar planning of the MiSRaR project. When the Dutch approach is combined with the provisional seminar planning, the following list of subjects arises (see on the right). The three stages of risk assessment directly correspond with seminars 1 to 5. However, the necessity of two separate seminars (6 en 7) on the overall subject of risk assessment should be reevaluated. It seems a bit redundant in the light of the seminars 1 to 5.

The phase of capability identification and capability analysis has as yet not been incorporated in the MiSRaR seminars. It could be taken into consideration to add this phase to one of the seminars.

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Notes

[1] *United Nations International Strategy for Disaster Risk Reduction*, *UNISDR Terminology on Disaster Risk Reduction*, UN ISDR, Geneva, 2009.
[2] Risk = probability (or likelihood) x impact (or consequence)
[3] Wilkinson, L: How to build scenarios, Wired [Scenarios: 1.01 Special edition], p. 84-81, 1995. http://www.gbn.com.