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TECHNICAL REPORT

The validity of the preference profiles used for evaluating impacts in the Dutch National Risk Assessment

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Prepared for the Dutch Research and Documentation Centre (WODC),
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Preface

The Dutch National Risk Assessment forms part of the wider National Security Strategy introduced in the Netherlands in 2007. The Strategy aims to protect society and civilians within its territory from internal and external threats. Preference profiles within the Dutch National Risk Assessment (NRA) help to describe the sensitivity of concerns about threat scenarios to assumptions about the importance of different impacts from these scenarios to members of the Dutch public.

RAND Europe was asked by the Research and Documentation Centre (WODC) Department of External Scientific Affairs, Ministry of Security and Justice, to assess the validity of preference profiles and associated weight sets currently used in the National Risk Assessment.

This document reports on the methods and analysis undertaken to assess the validity of preference profiles and associated weights. It also provides a set of recommendations on how the Ministry of Security and Justice can incorporate public values into the National Risk Assessment, using scientifically validated methods. The report should be of interest to individuals and organizations involved in strategic risk management.

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Contents

Preface.....	iii
Table of figures.....	vii
Table of tables.....	ix
Summary.....	xi
Acknowledgements.....	xv
CHAPTER 1 Introduction.....	1
CHAPTER 2 Overview of the National Risk Assessment Methodology.....	3
CHAPTER 3 Research approach.....	7
CHAPTER 4 Assessing the validity of the preference profiles.....	9
4.1 Is the multi-attribute model in the Risk Assessment methodology a valid approach to reflecting the range of values held in the Dutch population?.....	9
4.2 Do the four cultural worldviews used in the Risk Assessment methodology help to explain individuals' concerns about scenario impacts?	11
4.3 Do these cultural worldviews reflect the range of viewpoints that exist within the Dutch population?.....	12
4.4 Are the weights used in each cultural profile representative of the weights expected for the specified worldview?.....	13
4.5 Reflecting the range of values of the Dutch population in other aspects of the National Risk Assessment Methodology	14
4.5.1 Selection of scenarios	14
4.5.2 Specification of value functions.....	15
CHAPTER 5 Alternatives for improving the validity of the NRA preference profiles.....	17
5.1 Using preference profiles as currently proposed	17
5.2 Conducting surveys of members of the Dutch population to elicit sets of weights that can be used as representative preference profiles.....	18
5.3 Conducting sensitivity analysis that abandons the use of preference profiles and instead fully explores the influence of the importance weights on priorities.....	19

5.4	Abandoning the use of preference profiles and instead measuring concerns about the scenarios directly	19
5.5	Deriving preference profiles from an expanded survey of importance weights and direct assessment of the concerns about the scenarios.....	22
5.6	Comparing options for improving the validity of the preference profiles.....	22
CHAPTER 6 Concluding observations		27
REFERENCES.....		29
	Reference list.....	31
APPENDICES		35
	Appendix A: Description of preference profiles in the NRA	37
	Appendix B: Literature search results.....	40

Table of figures

Figure 2.1 Impact and likelihood of a scenario to form a risk diagram (adapted from: Min BZK, 2009).....	3
Figure 2.2 Risk diagram (adapted from: Min BZK, 2009)	4
Figure 2.3 Steps to obtain an overall impact score in the Dutch NRA.....	5
Figure 5.1 Steps in the deliberative method for ranking risks (adapted from Florig et al., 2001)	21

Table of tables

Table 2.1 The 10 impact criteria corresponding to the five vital interests (adapted from: Min BZK, 2009).....	4
Table 2.2 Weight distribution across different profiles (Adapted from: Min BZK, 2009).....	6
Table 5.1 Comparison of alternatives for improving the validity of the preference profiles used in the NRA.....	25

Summary

This report focuses on the validity of the sensitivity analysis methodology as it is applied in the National Risk Assessment (NRA). We advise readers who are unfamiliar with the NRA to read Chapter 2, which provides an outline of the NRA and how sensitivity analysis is conducted within the methodology.

The principal aim of the Ministry of Security and Justice is to maintain and advance a just and safe society within the Netherlands. In order to anticipate, tackle and mitigate potential threats that affect safety in Dutch society, the national government developed a National Security Strategy in 2007. The first step in this approach involves a country-wide identification of potential threats in the long-, medium- and short-term, and an assessment of their associated risks; the National Risk Assessment (NRA).

The NRA assesses the effects of threats across many impact criteria. These scores are aggregated into one impact score using the weighted sum method. By default each impact criterion is weighted equally in the aggregation. The result is a neutral impact score. This is the score used in the risk diagram; an important outcome of the NRA. However, people, differ in their opinions about the importance of the individual impact criteria. Some will undoubtedly want to ascribe different weights to different impact criteria. Different weights can change the position of the scenarios in the risk diagram. The NRA accounts for the diversity in values of the general public by conducting a sensitivity analysis on the impact scores using four sets of weights. Each set reflects a set of values corresponding to four specific value orientations called preference profiles.

There is no consensus about how the Dutch population combines impact criteria to form its perceptions of risks. Therefore, the Research and Documentation Centre (WODC), Department of External Scientific Affairs of the Dutch Ministry of Security and Justice asked RAND Europe to assess the validity of the preference profiles used in the NRA. This report summarises the results of this assessment by answering two main questions:

- Are the preference profiles that are used in the National Risk assessment valid?
- What is the most appropriate method for developing one or more weight set(s) that are representative of the Dutch population?

This report summarises the results of this assessment in the form of answers to four questions:

- Is the multi-attribute model in the Risk Assessment methodology a valid approach to reflecting the range of values held in the Dutch population?
- Do the four cultural worldviews used in the Risk Assessment methodology help to explain individuals' concerns about scenario impacts?

- Do these cultural worldviews reflect the range of viewpoints that exist within the Dutch population?
- Are the weights used in each cultural profile representative of the weights expected for the specified worldview?

To assess the validity of the preference profiles, we reviewed literature in the fields of decision analysis and risk perception and discussed our interpretations of this literature with several researchers familiar with these fields and/or the NRA methodology. The literature review indicates that the preference profiles used in the NRA have limited validity for describing concerns of the Dutch population about the impact of hazards. The weights used in the preference profiles have not been validated as representative, either of the cultural views they are meant to reflect, or of the cultural views of Dutch population.

However, there are several practical alternatives for improving the validity of how the NRA reflects views of the Dutch population beyond the current use of preference profiles. These alternatives include:

- Conducting surveys of members of the Dutch population to elicit sets of weights that can be used as representative preference profiles.
- Conducting sensitivity analysis that abandons the use of preference profiles and instead fully explores the influence of the importance weights on priorities.
- Abandoning the use of preference profiles and instead measuring concerns about the scenarios directly.
- Deriving preference profiles from an expanded survey of importance weights and direct assessment of the concerns about the scenarios.

In choosing between these alternatives, the Ministry of Security and Justice should consider several factors, including the effort required to implement each alternative, how frequently the analysis will need to be updated, and risks to successful implementation. Perhaps most importantly for decisions about the National Safety and Security methodology, the Ministry of Security and Justice should clarify whether the NRA method will be used to support a mathematical exercise based on the judgements of the NRA methodology working group, excluding public engagement, or expanded to incorporate a deliberative risk management process. Though the current process is an analytical exercise, the risk management literature suggests that incorporating public engagement into the policymaking process builds public confidence in governance, results in policies that more closely reflect community values and leads to greater public support for decisions (Renn, 2006). The most common criticisms of this form of deliberative risk management is that non-experts are not equipped with knowledge to understand risk assessments and that the public's risk perceptions will divert resources away from the most serious threats. However, risk communication studies have shown that these concerns are not valid (U.S. Department of Health and Human Services, 2002).

While the focus of this study was on the validity of the preference profiles used in the NRA, the values of the Dutch population enter into the NRA methodology in other ways. As the Ministry of Security and Justice continues to refine the National Safety and Security Method, consideration also should be given to some of the other ways that values are,

perhaps inadvertently, represented in the NRA by the officials conducting it. These include:

- The method through which the scenarios are selected.
- The inclusion in the impact criteria of factors suggested by the psychometric risk perception literature related to the ability of science to explain the cause-effects mechanisms leading to impacts.
- The precision with which science can estimate the impacts, and the catastrophic potential of the scenario.
- The value functions used to score scenarios on impact criteria.

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The principal aim of the Ministry of Security and Justice is to build a just and safe society within the Netherlands. In order to anticipate, tackle and mitigate potential threats that affect safety in Dutch society, the national government developed a National Security Strategy in 2007 (*Strategie Nationale Veiligheid*; Min BZK, 2007). The strategy aims to protect the Dutch society and civilians within its territory from internal and external threats. The national safety and security of the Netherlands is at stake when its vital interests and or society are under such threat that it could lead to social disruption. These vital interests, as described by the National Security Strategy, include:

1. Territorial security.
2. Physical security.
3. Economic security.
4. Ecological security.
5. Social or political stability.

Examples of potential threats to society include accidents, disasters and malicious attacks motivated by terrorism and crime. The approach described in this strategy uses a National Risk Assessment (NRA) to help the government select investment strategies to reduce the risks that jeopardise national safety or security. The approach is intended to allow the government to set priorities for preventing, managing or mitigating these risks, based on a comprehensive assessment of the risks likelihood and impact.

Assessing the impact of these risks requires making judgements about the importance of each vital interest and associated impact criteria. In the sensitivity analysis, the NRA describes how different segments of the Dutch population might perceive the impacts of threat scenarios that affect the Netherlands in different ways. Reliably capturing these perceptions in risk management is a challenging example of comparative risk assessment – a problem recognized internationally as being of critical importance to public policy as evidenced by recent UK, US and international efforts to review national risk assessments and provide guidance on how to incorporate values into risk management policy (HM Treasury, 2005; Renn, 2006; Committee to Review the Department of Homeland Security's Approach to Risk Analysis, 2010; Cabinet Office, 2008).

The proposed methodology for the Dutch National Risk Assessment, which is described in detail in Chapter 2, uses cultural theory when aiming to represent the values of Dutch citizens. With this approach, an integrated assessment of consequences is calculated as the weighted average of 10 impact criteria associated with the five vital interests listed above. The importance weights used in this calculation are meant to represent the preferences of

individuals who exhibit cultural profiles derived from cultural theory. The NRA method uses five sets of importance weights (i.e., preference profiles); one for each of the four cultural theory worldviews (i.e., egalitarian, hierarchical, individualist, and fatalist) and one that represents equal importance for all criteria. The specific weights used to represent each cultural profile are the result of interpretation and discussion among the NRA methodology working group (Min BZK, October 2009).

While Cultural Theory provides a mechanism for expressing how values influence perceptions of scenario impacts, the NRA documentation does not provide a clear rationale for adopting cultural theory as the organizing framework. Moreover, consensus does not exist about how people combine the impact criteria and vital interests to form their perceptions of these impacts and associated preferences for risk mitigation. Therefore, the WODC of the Dutch Ministry of Security and Justice asked RAND Europe to assess the validity of the preference profiles used in the NRA.

In this context, the primary questions addressed by this study are about the construct validity of the preference profiles. In other words, do the profiles measure the concept they are intended to measure? Construct validity of the preference profiles can be interpreted in several ways, including:

- Is the multi-attribute model in the Risk Assessment methodology a valid approach to reflecting the range of values held in the Dutch population?
- Do the four cultural worldviews used in the Risk Assessment methodology help to explain individuals' concerns about scenario impacts?
- Do these cultural worldviews reflect the range of viewpoints that exist within the Dutch population?
- Are the weights used in each cultural profile representative of the weights expected for the specified worldview?

This report summarizes answers to these questions. As background, Chapter 2 provides a brief overview of the NRA methodology. The approach used in this study, described in Chapter 3, consists of discussions with experts in risk assessment, decision analysis, and psychology of decision-making and synthesis of these discussions with published literature on these topics. These data provide insights into the validity of the preference profiles and answers to the principal questions about the validity of the preference profiles (Chapter 4) and options for improving how public and stakeholder values are incorporated into the NRA (Chapter 5).

CHAPTER 2 **Overview of the National Risk Assessment Methodology**

As described in Chapter 1, the Ministry of Security and Justice implements a risk assessment methodology as part of its strategy to protect society and civilians within its territory from internal and external threats. The approach involves a country-wide identification of potential threats to national safety and security in the short-term (up to six months), medium-term (up to five years) and long-term (more than years), and an assessment of their associated risks (Min BZK, 2009).

These threats are included in the NRA as scenarios of events that could threaten the national safety and security in the medium term. A scenario is a description of an incident, its causes, context, impact and the effects of the incident on the continuity of vital infrastructure. Each scenario is rated by experts against two aspects: likelihood and impact. With these two scores, a scenario can be plotted on a risk diagram (Figure 2.1).

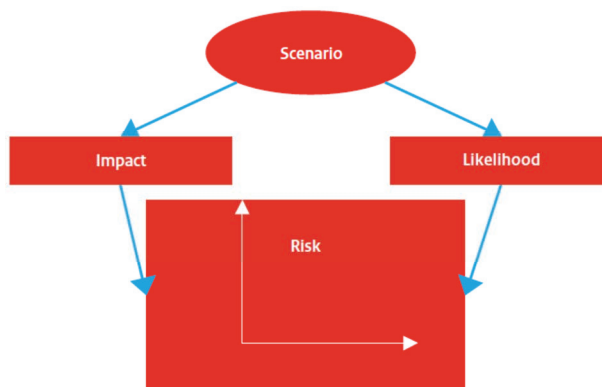


Figure 2.1 Impact and likelihood of a scenario to form a risk diagram (adapted from: Min BZK, 2009)

Plotting multiple scenarios, an overview is created that can help decision makers to prioritise the different scenarios (see, Figure 2.2). The present study focuses on the vertical axis of the risk diagram corresponding to Impact.

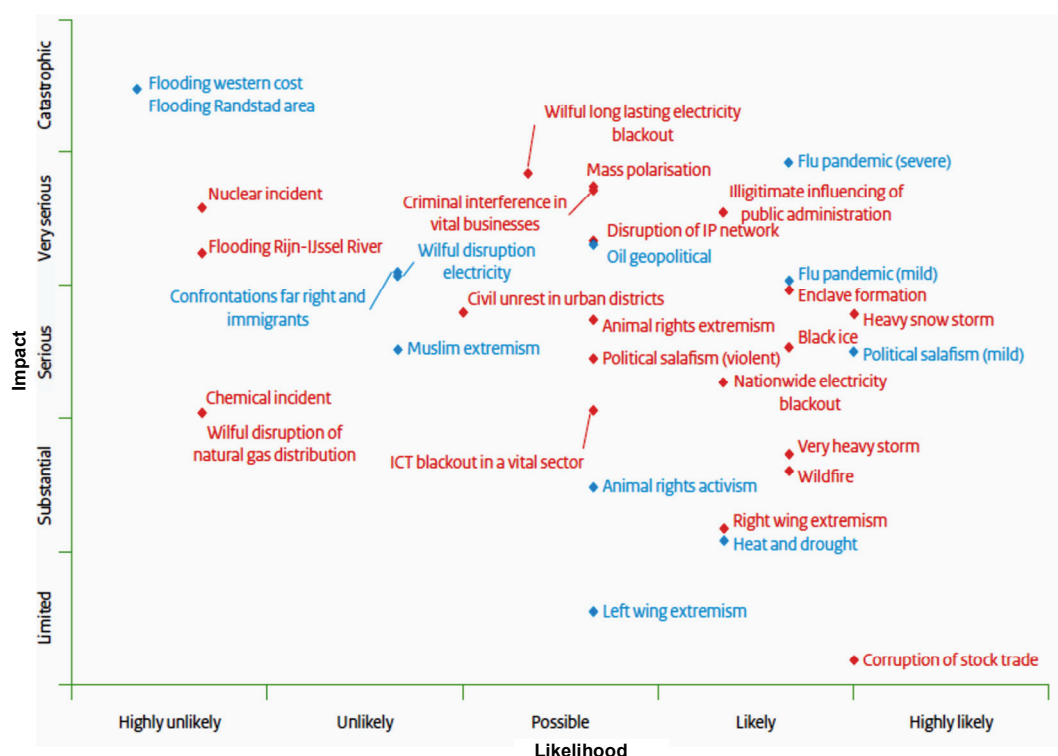


Figure 2.2 Risk diagram (adapted from: Min BZK, 2009)

Impact is determined by experts who evaluate each scenario in terms of 10 impact criteria. These impact criteria are directly related to five vital safety and security interests (see, Table 2.1). The vital interests and impact criteria were selected by individuals involved in developing this methodology but did not result from direct engagements with the Dutch population.

Table 2.1 The 10 impact criteria corresponding to the five vital interests (adapted from: Min BZK, 2009)

Vital interest	Impact criterion
1. Territorial safety	C1.1 Encroachment on the territory of the Netherlands C1.2 Infringement of the international position of the Netherlands
2. Physical security	C2.1 Fatalities C2.2 Seriously injured and chronically ill C2.3 Physical suffering (lack of basic necessities of life)
3. Economic security	C3.1 Costs
4. Ecological security	C4.1 Long-term impact on the environment and on nature (flora and fauna)
5. Social and political stability	C5.1 Disruption to everyday life C5.2 Violation of the democratic system C5.3 Social and psychological impact

As shown in Figure 2.2, each scenario is given an impact score for each of the 10 impact criteria: (A) Limited consequences, (B) Substantial consequences, (C) Serious consequences, (D) Very serious consequences, and (E) Catastrophic consequences.

An overall impact score for a given scenario is obtained as follows (Min BZK, 2009):

- The events and the impact for a given scenario are analysed against each of the 10 impact criteria.

- This analysis leads to the determination of an impact score for each criterion.
- The 10 individual impact scores are aggregated into an overall impact score. The aggregation is performed by first replacing the ordinal labels with values (i.e., an exponential value function with base of 3), then calculating the sum of all value scores multiplied with an importance weight. This weighted summation is the final impact score (e.g., $\text{Weight} * \text{Value C1.1} + \text{Weight} * \text{Value C1.2} + \dots$).

The importance weights used in calculating an integrated impact score are represented in preference profiles.

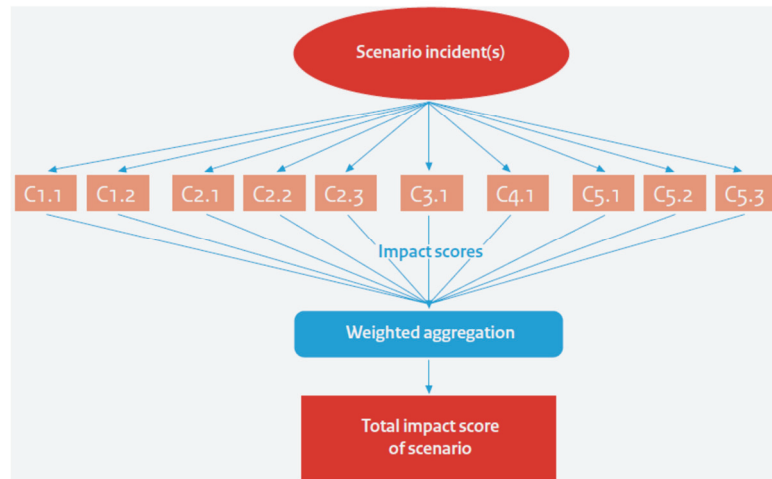


Figure 2.3 Steps to obtain an overall impact score in the Dutch NRA

People differ in their opinions about the importance of the individual impact criteria. For example, people differ in their views about the resilience of ecosystems (Criterion 4.1 long term impact on the environment and nature). Some think nature is robust and will quickly recover to its original state following disruption. Others think nature is vulnerable to disruptions from which it may never fully recover and has to be protected. People with different attitudes will undoubtedly want to ascribe different weights to this particular criterion. Different weights can change the position of scenarios in the risk diagram (Figure 2.2). The NRA accounts for diversity in values of the general public by doing an additional analysis of the impact scores. Instead of calculating impact using one set of neutral weights, impact is calculated with four alternative sets of weights. Each set reflects a set of values corresponding to four specific value orientations called preference profiles.

The preference profiles are based on an interpretation of Cultural Theory, which asserts that the way people perceive and respond to risks is influenced by the cultural biases through which they view the world (i.e., worldviews). These worldviews have been measured using scales that measure the extent to which people exhibit cultural biases related to their association with a group structure (i.e., group) in society and their views about stratification within society (i.e., grid). The four resulting worldviews defined using this group-grid structure are egalitarian (high group, low grid), hierarchical (high group, high grid), individualist (low group, low grid), and fatalist (low group, high grid) (Wildavsky and Dake, 1990). These four worldviews, along with a perspective representing equal importance of each impact criteria, constitute the five preference profiles used in the Dutch National Risk Assessment (Min BZK, October 2009):

- The equal weight perspective (Profile 00).
- The individualistic perspective (Profile A1).
- The egalitarian perspective (Profile B1).
- The fatalistic perspective (Profile A2).
- The hierarchical perspective (Profile B2).

The description of these preference profiles can be found in Appendix A.

The specific weights used are the result of interpretation and discussions among the NRA methodology working group and are shown in Table 2.2.

Table 2.2 Weight distribution across different profiles (Adapted from: Min BZK, 2009)

Profile	C1.1	C1.2	C2.1	C2.2	C2.3	C3.1	C4.1	C5.1	C5.2	C5.3	Total weight
00	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	100%
A1	6%	3%	14%	12%	12%	19%	2%	16%	8%	8%	100%
B1	5%	14%	12%	11%	9%	4%	13%	8%	13%	11%	100%
A2	11%	6%	13%	11%	12%	10%	4%	11%	11%	11%	100%
B2	9%	5%	13%	12%	12%	4%	13%	12%	10%	10%	100%

The research approach of the study focused on two parallel activities: (a) literature search and review and (b) e-mail survey and interviews. The literature review was undertaken using the strategies listed below, (number of sources retrieved shown in brackets):

- Literature search using the following keywords:
 - Cultural theory and risk perception [10]
 - Multi-criteria and comparative risk assessment [11]
 - Risk assessment [1]
 - Risk perception and Netherlands [10]
 - Netherlands & public & risk [2]
 - Netherlands & stakeholder & risk [5]
- References cited in the research proposal [18]
- References cited in a key article by Pruyt and Winjmalen (2010) [9]
- Suggested sources by the Steering Group [12]
- Sources provided by Professor Wandi Bruine de Bruin [4]
- Snowballing of selected articles identified in the previous steps [35]

These search activities resulted in a total of 117 sources, including articles and reports, the majority in English. Appendix B supplies a complete list of sources.

In parallel to the literature search and review activities, the project team sought expert opinions via e-mail, accompanied with a letter from the director of WODC. The experts contacted by RAND were largely recommended by the Steering Group.

The e-mail invitation provided a brief background to the RAND study, the purpose of the Dutch National Risk Assessment, a brief overview of the methodology, the overarching research questions of the study and the particular questions that would be addressed through the literature review. Finally, the e-mail invitation asked participants to respond to the following questions:

- To what extent do you think that the four worldviews given in the description of the NRA methodology properly reflect the variety of perspectives on life in general and on Dutch society in particular existing within the Dutch population?¹
- To what extent do you think that the four worldviews are associated with variations in public concerns about national risks?
- To what extent do you think that the four sets of importance weights given in the description of the NRA methodology are an adequate translation of the four worldviews?
- If you reflect on the task of weighting risk impacts on vital interests, and consider the list of relevant literature attached:
 - How and/or by which method(s) could different worldviews of the Dutch population be best assessed in a valid and reliable way?
 - How could worldviews or perspectives on society be best translated into valid sets of weights for the vital interests considered in the NRA?
- Which other published or unpublished sources of data or analyses could you recommend, that describe worldviews representing major segments of the Dutch population? If you can, please indicate any issues that might affect the feasibility of using those data or analyses in a Dutch decision-making context.
- Which other published or unpublished sources of data or analyses could you recommend, that describe the importance to segments of the Dutch of each of the impact criteria representing the Dutch ‘vital interests’ as described in the attached summary of the NRA methodology?
- Please indicate how and/or by which criteria one could evaluate any method(s) of representing Dutch public views in the National Risk Assessment through worldview, basic values, sets of importance weights, or other notions?
- How and/or by which method(s) could different worldviews of the Dutch population be best assessed in a valid and reliable way?

Following the recommendations made by the Steering Group, the project team e-mailed these questions to 17 researchers with expertise and contributions to the Dutch National Risk Assessment Methodology, psychology methods, risk scenario assessment and evaluation, sociology with expertise in worldviews and value orientations. RAND received responses from six of the 17 researchers and incorporated them into the findings discussed in Chapter 4 (Assessing the validity of the preference profiles).

The responses received to the email survey questions provided insight into possible concerns about the methodology, literature to review and possible alternative approaches to consider. However, these responses themselves cannot replace empirical work to validate the preference profiles.

¹ These questions were only put to experts familiar with the NRA methodology.

CHAPTER 4 **Assessing the validity of the preference profiles**

When assessing the validity of the preference profiles used in the NRA methodology, it is necessary to consider whether the cultural preference profiles used in the Dutch National Risk Assessment are theoretically sound; whether the estimates of preference weights used (i.e., the data) are representative of the range of views held by segments of the Dutch population; and whether the estimates for the weights result from reliable measurement. This study assessed each of these aspects of validity by answering the following questions:

- Is the multi-attribute model in the Risk Assessment methodology a valid approach to reflecting the range of values held in the Dutch population?
- Do the four cultural worldviews used in the Risk Assessment methodology help to explain individuals' concerns about scenario impacts?
- Do these cultural worldviews reflect the range of viewpoints that exist within the Dutch population?
- Are the weights used in each cultural profile representative of the weights expected for the specified worldview?

The summary below provides answers to these questions drawn from the literature review and discussions with experts.

While answers to these questions address the specific issues of validity raised by the WODC, a representation of Dutch cultural views enter into the risk assessment approach in other ways, including the selection of scenarios and the means of communicating assessments of scenarios across vital interests. Though they lie outside the scope of the current study, these issues are arguably just as important as the validity questions above and may be worth addressing in future refinements of the NRA methodology. With this in mind, we also provide insights from the literature on these aspects of the risk assessment methodology.

4.1 **Is the multi-attribute model in the Risk Assessment methodology a valid approach to reflecting the range of values held in the Dutch population?**

The risk assessment methodology incorporates a well-established approach to representing preferences; i.e., use of a multi-attribute value model. The attributes used are consistent with those used in other similar studies and thus have some degree of validity. However,

there are opportunities to increase the validity of the multi-attribute model used in the NRA.

Numerous studies have demonstrated that multi-attribute models can provide both a normatively valid and practical approach to helping individuals understand and communicate their preferences among alternatives, whether those alternatives are decisions about which house or car to purchase, the quality of a job applicant or even concern about risks like those addressed in the Dutch NRA (Dawes, 1988; Keeney, 1996). The validity of any approach for reflecting risk perceptions partly depends on whether the value model includes the correct set of attributes. In the context of the Dutch National Risk Assessment, this translates to whether or not the set of criteria related to the Netherlands' vital interests is both appropriate and complete enough to reflect the range of views in the Dutch population. Thus, the selection of impact criteria is related to the validity of the preference profiles in that the profiles can only be valid if they include importance weights for a valid set of criteria.

The criteria included in the National Risk Assessment Methodology appear to have been selected as the result of a deliberative process among its designers and are similar to those included in other studies that identify hazard characteristics affecting judgements of concern (for example see, McDaniels et al, 1996; Morgan et al, 2001; Willis et al, 2004; Cabinet Office, 2008; Levine et al, 2009; Willis et al, 2010). These studies span literature related to environment, health, safety, natural disaster, and terrorism hazards. The impact criteria used in the Dutch methodology are all commonly used in this body of literature. However, there are two ways in which the validity of the impact criteria could be improved.

First, the deliberative process used to select the impact criteria did not include engagement with members of the Dutch population other than those experts involved in developing the process. Thus, it is not possible to know whether the current set represents the characteristics salient to impact evaluation for all segments of the Dutch population. Future public engagement – through surveys or focus groups – could improve the validity of the set of attributes chosen. However, the extant literature suggests that such efforts would be likely to confirm that it is appropriate to include each of the existing impact criteria.

Second, there are additional characteristics that influence how individuals perceive the impacts of hazards that could be incorporated into the NRA methodology.

A robust body of literature on the psychometric theory of risk perception documents that two main characteristics of hazards contribute to how people perceive the associated impacts of risks:

- How familiar the hazard is.
- How much dread or negative emotion the hazard evokes.

This literature points to several characteristics of a risky scenario that are associated with these two psychological factors of risk, including:

- Whether effects are immediate or delayed.
- How familiar the causes of the risk are.

- Whether an individual can control their own exposure.
- How well science can explain the cause-effect mechanisms.
- How precisely science can estimate exposures and effects.
- How catastrophic a single incident of the scenario is.

These characteristics have been repeatedly shown to be predictive of individuals' judgements of concern about hazards (for example, McDaniels et al, 1996; Willis et al, 2005) and more recently have also been shown to be related to societal actions to boycott specific activities (Fischhoff, 2001), suggesting that the explanatory power extends beyond judgements to explain behaviours.

Many of these characteristics are already incorporated into the NRA methodology. For example, Criterion 5.3 (Social Psychological Impacts) incorporates individuals' unfamiliarity with the cause of the event, uncertainty about personal exposure and consequences, unnaturalness of event, effects on vulnerable individuals, aspects of trust and blame, and the familiarity and ability to control individual exposure. This set of characteristics does not explicitly incorporate three factors related to uncertainty in consequences: the ability of science to explain the cause-effect mechanisms, the precision of estimates of exposures and effects, and the catastrophic potential of a single incident. These factors arguably are related to Criterion 5.3 items on uncertainty about personal exposure and specification of the scenarios themselves. However, the validity of the preference profiles could be improved by more explicitly incorporating information about characteristics related to dread and uncertainty into the impact criteria used to describe scenarios.

4.2 **Do the four cultural worldviews used in the Risk Assessment methodology help to explain individuals' concerns about scenario impacts?**

The risk perception literature demonstrates that the range of cultural worldviews in a sample can be captured validly in a multi-attribute value model using different sets of importance weights. In fact, across a diverse range of hazards, risk perception studies have shown that different groups of people typically pay attention to the same set of impact criteria. Differences in their judgements of concern can therefore be explained by differences in the importance placed on each impact criterion that is the weight an individual assigns to each attribute (Vlek and Stallen, 1981; Willis and DeKay, 2007). This literature includes studies of Cultural Theory, as well as other worldviews that have been shown to be related to judgements of concern (Willis and DeKay, 2007; Slimak and Dietz, 2006). Thus, the Dutch Risk Assessment methodology's use of importance weights to capture preference profiles is a valid way of representing the range of differences in perceptions of impacts on safety and security among stakeholder groups in the Dutch population (see Appendix A, for definition of worldviews in the NRA).

However, it is also worth noting that the foundational literature on the links between cultural theory and perceptions of the impacts of hazards has not been validated empirically (Wildavsky and Dake, 1990; Boholm, 1996). The empirical studies conducted on Cultural Theory and perceptions suggest that worldviews are relatively poor predictors of an individual's concerns about a hazard. For example, several studies have shown that

Cultural Theory explains 10% or less of the variance in differences of perception of concern about a technology or hazard between one person and another (Marris et al, 1998; Oltedal et al, 2004). This is not surprising given that many other characteristics of individuals are also relevant to judgements of concern such as political views (Bouyer et al, 2001), level of trust in the public and private organizations that are associated with the hazards (Siegrist et al, 2000), and demographic characteristics such as gender and race (Olofsson and Rashid, 2011; Gutteling and Wiegman, 1993).

In summary, studies have demonstrated link between different types of worldviews and risk perceptions. However, those same studies suggest that the specific worldviews from Cultural Theory used in the NRA are not valid for predicting individuals' actual concerns about hazards and associated risks.

4.3 **Do these cultural worldviews reflect the range of viewpoints that exist within the Dutch population?**

The documentation of the Dutch National Risk Assessment describes the worldviews (see, Appendix A for definitions) as being derived from the literature on Cultural Theory and having been used previously in assessments done by the Intergovernmental Panel on Climate Change (IPCC, 2000) and the value orientations of the WIN model of TNS-NIPO (NIPO, 2002; RIVM, 2004). The literature on Cultural Theory is well established, and its robustness derives partly from the fact it has been confirmed in several different cultures. This gives reason to believe that the worldviews derived from Cultural Theory are valid representations of a portion of those views held by members of the Dutch population (Rippl, 2002; Sjöberg, 1998; Wildavsky and Dake, 1990).

At the same time, the empirical literature suggests some reason to question whether these four worldviews are comprehensive. Surveys of how individuals' views align with the worldviews prescribed by Cultural Theory have found that only a minority of the population can be described as adhering to a single worldview. For example, Marris et al. (1998) found that only 32% of study participants could be clearly associated with a single cultural view, while the remaining participants could at best be described as having mixed cultural views.

Worldviews that are missing from cultural theory but have been found to be relevant to concerns about hazards include views about the environment (Willis and DeKay, 2007), social trust (Siegrist et al, 2000), personality factors such as anxiety and other negative emotions (Bouyer et al, 2001), personal norms (Slimak and Dietz, 2006), and national culture.² Another way of assessing worldviews, though not yet shown to be connected to risk perceptions, is a survey commonly used to help the Dutch population identify the political party that most appropriately reflects their views.³

In the absence of a direct survey-based assessment of the worldviews of the Dutch population, there is no way to validate whether the cultural views prescribed by Cultural

² For example, <http://geert-hofstede.com/netherlands.html>

³ See <http://welkepartijpastbijmij.nl/>

Theory accurately represent the full range of worldviews that exist in the Dutch population, or help to predict their concerns about the impacts of hazards. Strictly speaking, the approach used by the Dutch National Risk Assessment has not yet been appropriately validated. Moreover, there is reason to question its validity, because evidence in the literature suggests that most individuals exhibit more than one cultural worldview prescribed by Cultural Theory and that other worldviews are also important for predicting concerns about hazards.

A survey of the Dutch population would be necessary to validate whether or not Cultural Theory alone can describe the range of worldviews in the Dutch population, and is sufficient for predicting their concerns about hazards. However, because of the limited published evidence supporting Cultural Theory, and the promise of alternative approaches, such a survey should be designed to test the relative merit of multiple approaches. Indeed, it is important to consider the merits of pursuing alternative approaches to capturing the Dutch populations' concerns about risks.

4.4 **Are the weights used in each cultural profile representative of the weights expected for the specified worldview?**

The weights used in the NRA preference profiles would ideally reflect the importance that an individual influenced by one of the cultural theory worldviews would place on the impact criteria. These could be elicited from an individual who has been identified through a survey as exhibiting a specific worldview. However, there is no empirical basis for the weights used in the NRA to reflect each preference profile in the Dutch risk assessment (see Table 2.2).

According to the documentation for the Dutch risk assessment methodology, the weights used to reflect the four preference profiles were selected on the basis of the designers' intuitions about how individuals with these preference profiles would feel about hazards, and not on the basis of empirical data. In fact, we could not identify studies that could support a valid representation of the Cultural Theory worldviews in terms of weights for the vital interests and impact factors either in the Netherlands or elsewhere. Furthermore, no universal set of importance weights can consistently represent the views of any group, because the importance of any criteria for a decision depends on the range of consequences that exist among the choices being considered (Keeney, 2002). For example, when considering choices among cars, an individual might be concerned about cost. However, when choosing two cars that cost relatively the same amount and differ greatly on another characteristic (e.g., fuel economy), cost may not influence the preferred choice. Likewise, in order to assess which scenarios present the greatest risks, it is necessary to consider the range of consequences across the scenarios being considered.

Theoretically, a single set of weights could exist for each worldview. A set of universal weights would only be valid under two conditions. First, these weights would have to be estimated under full consideration of all possible consequences across the current set of scenarios. Second, the current set of scenarios would need to represent the entire range of consequences that could ever exist across all possible scenarios over time. In practice, it is impossible to know or verify whether the second of these conditions exists. It is always

possible than an unforeseen scenario with unexpected consequences could emerge in the future, changing the range of possible consequences and the relevant decision weights.

In summary, in the absence of empirical data, the weights used in the preference profiles of the Dutch risk assessment methodology have not been validated. A survey would be needed to determine the appropriate weights for reflecting the views of an individual holding a specific cultural worldview. However, as noted in this section, such a survey is naturally limited to the current set of relevant scenarios, and may not reveal the weights that would reflect all possible scenarios over time. Given the limited explanatory power of cultural theory, and the limitations of what can be learned from a survey, it is appropriate to consider the merits of conducting further alternative approaches to capturing Dutch people's concerns.

4.5 **Reflecting the range of values of the Dutch population in other aspects of the National Risk Assessment Methodology**

While the focus of this study is the validity of preference profiles used in the NRA, other components of the methodology can reflect public values. For example, the choice of scenarios, impact criteria and value functions used to assess scenarios across impact criteria can all also encode public values (Florig et al, 2001; Morgan et al, 2001; Keeney, 1996). In fact, methodologies described by the International Risk Governance Council and the United Kingdom's Treasury Ministry outline how to integrate public values into these aspects of a national risk assessment process (Renn, 2006; HM Treasury, 2005). These methods provide a comparison against which to assess the validity of the broader approach of how public values are reflected in the Dutch National Risk Assessment. Several aspects of the methodology have already been addressed in Chapter 2.

Section 4.1 describes how the values of members of the population are reflected in the choice of impact criteria. Thus, this section focuses on the two remaining components of the risk assessment methodology that can reflect public values – selection of scenarios and the value functions used to assess scenarios. As the Ministry of Security and Justice considers refinements to the National Safety and Security process, these aspects of the NRA methodology deserve review.

4.5.1 **Selection of scenarios**

The documentation for the Dutch National Risk Assessment methodology suggests that the scenarios included in the methodology resulted from deliberations within the Dutch government. This is entirely appropriate and consistent with Florig and colleagues (2001), who recommend that comparative risk assessments ask participants to compare items categorized in a manner that aligns with how the government (or other responsible institution) is best organised to manage them.

At the same time, the literature on risk management indicates that the scenario selection step is a useful point at which to engage the public in the risk management process (Renn, 2006; Stirling, 2008). Through this kind of engagement risk managers can be certain not to exclude events of public importance (either in kind or in magnitude) in the risk management process.

It is not clear from the documentation how and to what extent members of the Dutch population were engaged in the process of defining scenarios. As the Dutch National Risk Assessment method evolves, opportunities to enhance this aspect of the methodology may emerge.

4.5.2 Specification of value functions

The documentation materials indicate that the scoring criteria used in the risk assessment methodology incorporate public preferences in several ways. Examples of ways in which public preferences are reflected in the scoring criteria include:

- Use of ordinal consequence category scores: The practice of scoring scenarios using ordinal categories (i.e., letter grades of A through E) can be interpreted as implying risk increases in ordered steps with increased consequences. However, the magnitude with which risk increases is not specified and may be interpreted by some people as being a linear increase with each step.
- Use of logarithmic categorization schemes: The assignment of ordinal scores associates the ordinal grades (i.e., A through E) with logarithmic changes in the level of consequences. For example, increasing scores for fatalities are associated with an order-of-magnitude increase in the number of expected fatalities. The same approach is used for absolute area affected, injuries, physical suffering, and costs.
- Association of controllability, delay of effects, and knowledge with riskiness: The scoring criteria associate less knowledge, more immediate effects, and less control with greater concern. However, studies of individuals' risk perception have found significant variation among individuals in how these factors affect risk perceptions and conflicting conclusions at the aggregate level (Lazo et al, 2000; Bronfman and Cifuentes, 2003; Willis et al, 2005; Willis et al, 2004; Bronfman et al, 2004; Baron et al, 2000; Slovic et al, 1985; Morgan et al, 2001; Jenni, 1997; McDaniels et al, 1996; 1995; McDaniels et al, 1997).

Once again, the documentation is not clear about whether these design choices reflect explicit valuation based on engagement with members of the Dutch population. Also, some literature suggests that the specific value function used may not affect judgements dramatically (Morgan, 1999). However, to the extent that the method did not involve engagement with the public, several options exist to improve this aspect of the methodology, including conducting surveys to select the most appropriate value functions or adopting a scoring approach that does not require converting the impact criteria assessments to common metrics.

CHAPTER 5 **Alternatives for improving the validity of the NRA preference profiles**

There are several aspects of the validity of the preference profiles in the NRA methodology that could benefit from new data or methods. While these same sources do not provide a basis from which preference profiles can be derived, the literature does provide alternatives for the Ministry of Security and Justice to consider as it continues to evolve and apply the National Safety and Security Method. These alternatives fall into five basic categories:

1. Using preference profiles as currently proposed.
2. Conducting surveys of members of the Dutch population to elicit sets of weights that can be used as representative preference profiles.
3. Conducting an expanded sensitivity analysis that fully explores the influence of the importance weights on priorities.
4. Abandoning the use of preference profiles and instead measuring concerns about the scenarios directly.
5. Deriving preference profiles from an expanded survey of importance weights and direct assessment of the concerns about the scenarios.

The remainder of this Chapter describes these alternatives in greater detail and provides a summary of the merits of each approach.

5.1 **Using preference profiles as currently proposed**

The status quo for the NRA is to use the preference profiles as they are currently discussed in the methodology documents for the National Safety and Security method (Min BZK, October 2009). This alternative would retain the five perspectives with labels drawn from the cultural worldviews derived from Cultural Theory as well as the importance weights for each profile, which were set by the methodology working group on the basis of discussions about what values might be expected for an individual holding the associated cultural worldview. In this context, the preference profiles can be used to conduct a limited sensitivity analysis of the robustness of scenario rankings. Using this approach, analysts could compare concerns predicted by each of the five preference profiles currently used and provide decision makers with insight about cases in which the importance of a scenario is highly dependent on the specification of a preference profile.

However, the preference profiles have not been specifically validated to represent worldviews among the Dutch population. Furthermore, given the literature discussed

above, the preference profiles are unlikely to be a valid representation of the range of cultural views held by members of the Dutch population or predictive of their concerns about hazards.

5.2 **Conducting surveys of members of the Dutch population to elicit sets of weights that can be used as representative preference profiles**

Chapter 3 concludes that the choice of cultural worldviews used in the NRA and the weights used to represent these culture viewpoints are currently not supported by survey data from members of the Dutch population but they could be. Surveys could cover three topics.

First, surveys could be used to determine the proportion of Dutch individuals whose beliefs fit within each of the worldviews, as compared to other worldviews discussed in the risk perception literature. In the social and political sciences, several repeated national surveys are available (European Value Studies: EVS; Social and Cultural Trends in the Netherlands: SOCON; and The Dutch Election Studies). The public distribution of the data files and documentation is handled by DANS: Data Archiving and Networked Services (See: www.dans.knaw.nl). The conceptualization and measurement of several worldviews can be found in these studies, including worldviews related to:

- Politics: Localism and cosmopolitanism, materialism and postmaterialism, participation in conventional and unconventional political activities, political orientation (left-right).
- Social-cultural attitudes: Economic conservatism (elements are opposition in income and status equalization, opposition to government intervention and opposition to tougher trade union policy) and cultural conservatism (elements are: restriction of civil rights, rejection of intervention in life and death; traditional view on women).
- Environmentalism: Willingness to act and make sacrifices on behalf of ecology.
- Religiosity: Transcendentalism, innerworldly orientation (immanentism), agnosticism, atheism.
- General values: Traditional family values (familialism), traditional achievement values, hedonism, social criticism (egalitarianism), autonomy.
- Social characteristics: Political party preference, denomination, age, education, income and region.

The link from these worldviews to the psychological determinants of risk perceptions has yet to be studied.

Second, surveys could be used to estimate the importance weights that individuals place on each of the impact criterion. If surveys of importance weights are conducted, they should be done to appropriately capture the weights of the hierarchical objective tree outlined among vital interests and impact criteria and reflect consideration of the variance in outcomes for the impact criteria across scenarios (Stillwell et al, 1987; Keeney, 2002; von Winterfeldt and Edwards, 1986).

Third, surveys could include assessments of concerns about specific hazard scenarios. These judgements could then be used to examine how well cultural worldviews predict concerns about hazards, as compared to other approaches that have been identified in the risk perception literature. Data from such surveys might, depending on the results, allow the Ministry of Security Justice to support claims that the preference profiles represent the range of views that exist within members of the Dutch population. Because prior studies suggest few people exhibit a single cultural view it is unlikely that the surveys will confirm the comprehensiveness of the profiles.

5.3 **Conducting sensitivity analysis that abandons the use of preference profiles and instead fully explores the influence of the importance weights on priorities**

As described in the documentation for the NRA methodology, the profiles serve four purposes (Min BZK, October 2009) to:

- Illustrate differences of diversity among public values on concerns about risks.
- Assess the robustness of rankings to diversity in public values.
- Provide a starting point for sensitivity analysis.
- Avoid the need to specify weights for all public viewpoints.

As stated, the profiles are not meant to describe the actual concerns of the Dutch population. Thus, for these purposes, the profiles themselves may be unnecessary. Instead, one could abandon preference profiles and conduct a broader sensitivity analysis that varied the importance weights for each impact criterion across its full range (i.e., 0 to 1) and considered a very large number of profiles that reflected the full combination of possible importance weights. These profiles could then be examined to understand which result in the most dramatic shifts in concerns about hazard scenarios and which are most sensitive to changes in profiles.

This extreme approach to sensitivity analysis is conceptually similar to an analytic method known as Robust Decision Making (RDM) (Lempert et al, 2006). RDM was developed to support decision making in contexts where there are many competing objectives and deep uncertainty about future risks. It has since been applied to policy analysis in the areas of climate change (Lempert and Kalra, 2011), water resources management (Lempert and Groves, 2010), and coastal restoration of areas threatened by severe flooding (Fischbach, 2010). Documentation of the NRA indicates that approaches similar to these have already been considered (Pruyt and Wijnmalen, 2010).

5.4 **Abandoning the use of preference profiles and instead measuring concerns about the scenarios directly**

The International Risk Governance Council's recommended practice for strategic risk management emphasizes the importance of incorporating public views through deliberative policymaking (Renn, 2006). This practice has been most closely implemented by the UK government through its guidance for risk management (HM Treasury, 2005). According to these sources, such deliberative processes enable risk management to be more responsive

to public choices in a democratic process and lead to greater public support of policies and trust in public institutions. If the Ministry of Security and Justice were to reconsider its current approach and choose to implement a deliberative risk management process, it might also reconsider whether to measure importance weights and instead directly measure public concern about the hazard scenarios.

From the perspective of measurement theory, directly measuring concerns is preferable to measuring importance weights, or adherence to worldviews. If the topic of principal interest is public concern about hazard scenarios, the most direct way to assess this is to measure directly the least proximal measure of those concerns, which would be adherence to worldviews.

Directly measuring the concerns of members of the Dutch population would not strictly speaking improve the validity of the preference profiles used in the NRA, but could increase the validity of the results of the NRA itself. As we have described in this section, there are approaches for eliciting concerns could be incorporated into the NRA approach. However, doing this may require the NRA to recast its purpose as assessment of concern rather than an assessment of impact.

The most common criticism of engaging members of the public in risk management is that non-experts are not equipped with the knowledge to understand risk assessments and that the public's risk perceptions will divert resources away from the most serious threats. However, guidance on best practices for risk communication studies offers reasons why these concerns are not valid. In fact, effective risk communication has been shown to inform people without generating concern even when they don't have expertise in specific subject matter. Furthermore, engaging the public need not divert resources away from less pressing risks. Listening to public concerns is the only way to ensure the public's views are represented but it need not dictate policy (U.S. Department of Health and Human Services, 2002).

Attempts to measure concerns about scenarios directly should adhere to two tenets. First, the assessments of public concerns about scenarios should capture judgements that are based on knowledge of accurate facts, provided by experts. Second, the concerns should be measured using scientifically valid methods that will capture reliable and unbiased judgements. One approach that satisfies these criteria is the deliberative method for ranking risks developed at Carnegie Mellon University (Florig et al, 2001; Morgan et al, 2001).

The deliberative method has five steps (see Figure 5.1): (A) categorizing the hazard scenarios; (B) identifying the characteristics of those scenarios that must be described if individuals are to provide informed judgements of concern; (C) having experts summarise the current scientific assessments of the scenarios in terms of all relevant characteristics; (D) eliciting judgements of concern about the scenarios; and (E) describing the preferences, as well as consensus and disagreement about those preferences. The current NRA methodology provides the information necessary to accomplish the first two of these steps. This material could be used to communicate risk information when attempting to elicit judgements of concern (Step C).

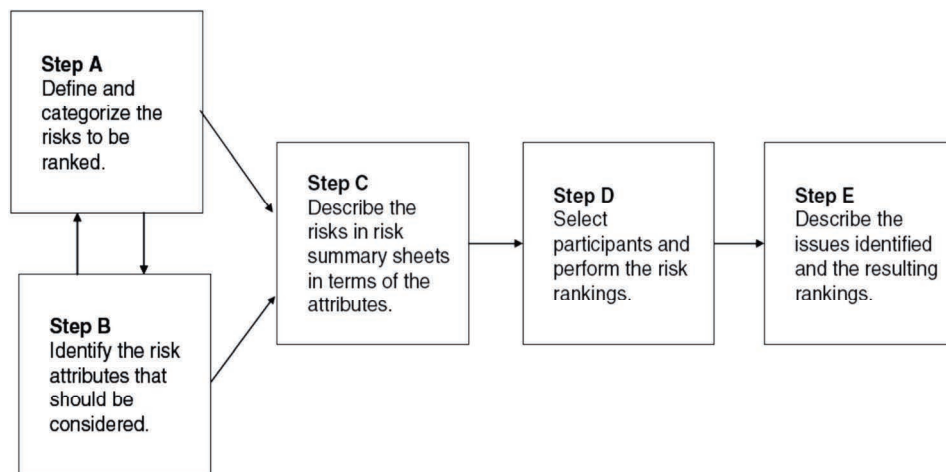


Figure 5.1 Steps in the deliberative method for ranking risks (adapted from Florig et al., 2001)

The process for ranking risks in the Carnegie Mellon approach (Step D) builds on validated decision sciences methods of eliciting preferences from individuals and groups. The first step in this process is to allow people to rank the hazards after reviewing the current knowledge of the risks. Next, because ranking these risks is a complex cognitive task, participants are guided through use of a multi-attribute approach to calculating a ranking of the hazards based on their perceptions of the risk characteristics. The existing NRA methodology could form the foundation of this multi-attribute approach. Then, because people can learn about hazards from each other, participants are led through a facilitated group process to produce a consensus ranking of the hazards. Finally, because group processes could lead to forced consensus, participants are given a final opportunity to express their concerns by dissenting from the group or incorporating new insights into their original rankings.

This method has been evaluated and validated for producing reliable, unbiased estimates of individuals' concern about a wide variety of risks. Applications have included accidents, public health, natural disasters, environmental health risk, and terrorism. These applications have involved assessments by both the general public and by risk managers responsible for setting and implementing risk management policy. While the results have been replicated in both groups, it is a question of risk governance as to whether it is more desirable to elicit risk rankings from government officials or members of the general public (Florig et al, 2001; Willis et al, 2004; Willis et al, 2010; Morgan et al, 2001).

Because the deliberative method for ranking risks elicits judgements from focus groups, it is expensive to use this method alone to collect judgements from a nationally representative sample. It can be challenging to reveal all potential differences in viewpoints among groups, especially if a viewpoint is held by a minority of the population. To address this, consideration has been given to complementing this type of deliberative approach with other preference elicitation survey methods and online deliberative survey tools, such as best-worse scaling methods or online Delphi tools. Ultimately, the usefulness of this method will depend on how important public engagement is for risk governance and whether the resources are available to support this type of process (Potoglou et al, 2011; Dalal et al, 2011).

5.5 **Deriving preference profiles from an expanded survey of importance weights and direct assessment of the concerns about the scenarios**

Despite the lack of empirical evidence to support the preference profiles used in the NRA, it is possible that there is a set of profiles that describe the range of perspectives on security and safety risks in the Netherlands. An alternative approach to identifying these profiles would be to derive them directly from elicited judgements of concern among the Dutch population.

Such a survey would involve three components. First, the survey would elicit from each participant a judgment of how risky they perceived each scenario to be. Ideally, this judgment should be informed by summaries of the current science and more than just a named scenario⁴. Second, the survey would elicit importance weights for each vital interest from each participant. Ideally the importance weights would be elicited using the swing weight method, which accounts for the variation in consequences across the set of scenarios being considered (von Winterfeldt and Edwards, 1986). The third component of the survey would be to elicit scales that measure adherence to cultural views, social norms, or other worldviews, perhaps based on the survey proposed in 4.1.

Multivariate statistical analysis of these data sets may reveal patterns of relationships between riskiness judgements and importance weights. If clusters of groups emerge from a representative survey of the Dutch public, they may be useful as emergent preference profiles. It would be possible to divide survey participants into groups, based on their riskiness judgements. Then, by analysing the elicited weights for each cluster, it might be possible to derive sets of preference profiles (i.e., sets of importance weights). The statistical analysis could describe how well the preference profiles explain variations in riskiness judgements across the scenarios. These profiles could then be compared to profiles associated with Cultural Theory and other worldviews, which can also be derived from these data sets.

Depending on the size of the survey sample and the sampling methods used, it may be possible to assess whether an emergent set of profiles comprehensively describes the range of views of Dutch individuals.

5.6 **Comparing options for improving the validity of the preference profiles**

This study has identified several open questions that are not answered by existing literature and are relevant to the NRA methodology:

- What set of worldviews would represent the diversity of perspectives in the Dutch population?
- What preference profiles provide a valid representation of the worldviews that exist in the Dutch population?

⁴ One reason why riskiness judgements vary is because respondents conceive the scenarios differently. When given only a scenario name, this type of error can be expected to be larger than when respondents are given further details. Other details could include a descriptive paragraph or a concise summary of the scientific knowledge of the scenario.

- How does the Dutch public perceive the impacts of the scenarios addressed by the NRA methodology?
- How well do the worldviews that exist in the Dutch population explain concerns about the impacts of scenarios addressed by the NRA methodology?
- Would incorporation of a deliberative risk management process into the NRA provide added value to the Ministry of Security and Justice?

The five alternatives described in this chapter differ in many ways and could answer these questions. However, the choice of which alternative to adopt and how to improve the validity of the use of preference profiles in the NRA is not an obvious one. To provide the Ministry of Security and Justice with insight into the pros and cons of each alternative, we have described them in terms of the following four criteria:

- Effort required to implement. Each of the methods described here requires a different amount of personnel, funding and time. To some extent these are interchangeable. For example, with more people it may be possible to accomplish some tasks in a shorter time. The principal difference between the alternatives being considered is whether or not they require new data to be collected and how those data are collected.
- Requirements for updating. Some of the alternatives will produce results that can be considered current for a number of years. Other alternatives will need to be performed frequently. To the extent that results can be reused for several years, this alternative consumes fewer resources.
- Representation of public views. Some of the methods provide direct insight into public views. Others provide only indirect insight or none at all. To the extent that the Ministry of Security and Justice chooses to adopt methods consistent with deliberative risk management (Renn, 2006), this criterion is relevant.
- Risks to successful implementation. For some of the alternatives, the literature provides evidence that the planned approach can be successfully implemented. For others, it is not clear that the results will provide useful insights. In these cases, the Ministry of Security and Justice risks making little progress after having attempted the alternative.

Table 4.1 summarizes this assessment. In the end, the applicability of the alternatives to the NRA depends on how the Ministry of Security Justice prefers to use the method. The two primary options are to use the NRA as:

- A mathematical exercise, based on the judgements of the NRA methodology working group for calculating how variations in concerns about the scenarios may change with a lack of public engagement, untested and possibly unrealistic differences in the importance of impact criteria.
- A deliberative exercise to understand which scenarios members of the Dutch population view as most worrying and use this information to shape a data-driven risk management strategy.

If the NRA is viewed as a mathematical exercise, the most convenient option is to conduct a broader sensitivity analysis with full exploration of weights. Additional effort may

provide an empirical justification for the worldviews. However, if the NRA is used in this fashion, the worldviews serve little purpose.

If the NRA is viewed instead as a deliberative risk management exercise, some effort will be needed to assess the range of views of the Dutch population directly. The methods described in this chapter for assessing Dutch people's concerns about hazards can fully leverage the existing NRA analysis. If the set of scenarios is believed to be very stable it may be worth investigating whether there are preference profiles that can differentiate between the concerns of the Dutch population. If they do, the profiles themselves could be used to understand how new scenarios should be considered in comparison to the current set.

Table 5.1 Comparison of alternatives for improving the validity of the preference profiles used in the NRA

Alternative	Effort Required to Implement	Requirements for Updating	Representation of Public Views	Risks to Successful Implementation
Using preference profiles as currently proposed	Little additional effort required.	If a set of scenarios is stable, profiles can be useful for about five years, assuming Dutch demographics and preferences are also both relatively stable. If new substantially different scenarios are added, assessment must be redone.	Public views poorly reflected through this analysis.	<ul style="list-style-type: none"> • Risk management plans not accepted as being responsive to public concerns • Trust in public institutions is eroded because of perceived lack of transparency
Conducting surveys of Dutch population	Effort required to design and field survey. Can be done relatively efficiently, scaled easily, and reassessed easily once developed.	Same as use of current preference profiles.	Depending on results, surveys could confirm that Dutch views are reflected in analysis.	<ul style="list-style-type: none"> • Surveys may not confirm that worldviews reflect range of views across the Dutch population. • Risk management plans may not be accepted as being responsive to public concerns • Trust in public institutions may be eroded because of perceived lack of transparency

Alternative	Effort Required to Implement	Requirements for Updating	Representation of Public Views	Risks to Successful Implementation
Conduct sensitivity analysis with full exploration of weights	Little additional effort required.	Only needs to be done when National Security and Security Strategy are being reconsidered.	Public views are poorly reflected through this analysis.	<ul style="list-style-type: none"> • Risk management plans not accepted as being responsive to public concerns • Trust in public institutions is eroded because of perceived lack of transparency
Measure judgements of concern directly	Can use the data developed for the current NRA analysis, but will require conducting focus groups. Method does not scale as easily as surveys.	If set of scenarios is stable, profiles can be useful for about five years assuming Dutch demographics and preferences are both relatively stable. Must be redone every time a new scenario is added.	Results will describe public consensus and disagreement about riskiness of scenarios and identify the reasons for disagreement when it exists.	<ul style="list-style-type: none"> • Analysis needs to be redone frequently if set of scenarios is not stable
Deriving profiles from judgements of concern	Depends on how this is done. Can range from equivalent effort to conducting surveys of weights and preference profiles to methods based on focus groups.	If set of scenarios is stable, profiles can be useful for about five years assuming Dutch demographics and preferences are both relatively stable. If new substantially different scenarios are added, assessment must be redone.	These results will reflect public views on riskiness of hazards and importance of vital interests.	<ul style="list-style-type: none"> • Analysis may not reveal emergent profiles • Analysis may need to be redone if set of scenarios is not stable

The National Safety and Security Method represents an ambitious, enlightened, and yet developing approach for setting national priorities for risk management. As part of this method, the NRA has the potential to provide planners with a rigorous description of the threats to the Netherlands from which to develop a reasoned strategy.

The literature on decision analysis and risk perception reviewed in this report indicates that unfortunately the preference profiles used in the NRA approach have limited validity for describing the concerns of members of the Dutch population and that the weights used in the preference profiles have not been validated as being either representative of the range of cultural worldviews they are meant to reflect or predictive of Dutch people's concerns about hazards.

As the Ministry of Security and Justice continues to develop the National Safety and Security Method, consideration should also be given to some of the other ways that values are represented in the NRA. As described in Chapter 4, these include the method through which the scenarios are selected, the possible inclusion of other factors suggested by the literature on psychometric determinants of risk perception and the value functions used to score scenarios on impact criteria.

There are several practical alternatives for improving the validity of the approach in order to assess better Dutch people's concerns about hazards. In choosing among the alternatives described in Chapter 4, the Ministry of Security and Justice should first clarify whether the NRA method will be used to support a hypothetical mathematical exercise that has no connection with Dutch people's concerns about hazards or will be expanded to incorporate a valid deliberative risk management process that accurately reflects Dutch people's concerns about hazards, using a national survey and focus groups.

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APPENDICES

Appendix A: Description of preference profiles in the NRA

Profile A1

The individualistic perspective – the global market: This profile represents the outlook of rather materialistic liberal entrepreneurs. These ‘individualists’ do not wish to be bound by a group or rules. They have firm belief in a meritocracy, the free market and technological progress. The free market economy is a vital interest like other interests that support the global free market. Success and merit are a personal responsibility, which is why individual liberties must be guaranteed. These individual liberties would be jeopardised in the event of disruption of everyday life. Furthermore, government interference is not appreciated. They find the quest for an individually stimulating and comfortable life to be more important than average. As long as harm to the democratic constitutional state, encroachment on the territory or harm to the integrity of the international position of the Netherlands does not affect that quest, they will consider these phenomena of lesser importance. In the event of a disaster, they nevertheless feel that fatalities, injuries and the chronically sick, as well as a lack of the basic necessities of life are important – especially when they and their nearest and dearest close relations are affected. They find social indignation and fear less important, as they do harm to nature which is assumed to be defensible.

Profile B1

The ‘egalitarian’ perspective – global solidarity: This profile represents the outlook of rather egalitarian citizens, who are in favour of solidarity, and keen on social and long term ecological stability. Equitable development of international and national social prosperity and welfare is what counts for these ‘egalitarians’. They believe that nature is very important and vulnerable, and therefore needs to be protected. They also assume that inequality between people is unacceptable. That is why they find harm to the democratic constitutional state and social indignation and fear very serious matters. In the case of disasters, fatalities, injured, chronic illnesses and a lack of basic necessities of life – whoever is affected – this is considered very serious. Temporary disruption of everyday life is not considered serious. Such situations even lead to a desired side effect, namely to solidarity (for example with those whose daily life is always disrupted). The economy is of lesser importance: It is only a means, not an end in itself. ‘Egalitarians trust the government to

manage collective property and correct failures of market forces. They have a particularly international outlook: harm to the integrity of the international position of the Netherlands is perceived as more problematic than harm to the integrity of Dutch territory. 'Egalitarians are very strongly bound and determined by the group to which they belong, but are less inclined to accept rules, certainly if these interfere with their belief in the need to protect the weak, vulnerable nature, etc.

Profile A2

The 'fatalistic' perspective – the safe region: This profile represents the outlook of rather fatalistic citizens. These fatalists feel strongly bound by rules, and excluded from a real tight-knit group member society, which leads to a feeling of powerlessness and a fatalistic attitude. These concerned citizens want to keep what they have, in terms of property and social values. Their preferred society is a closed, safe, liveable society, in other words, a safe region. They consider encroachment on the territorial integrity of the Netherlands as serious. The integrity of the international position is of lesser importance. Mistrustful of human nature, the emphasis here is on personal responsibility or that of certain interest groups, authorities (through expertise and experience) and certain institutions (politicians, security and judiciary). They are keen on social stability and, and this can be achieved through regulation, standards and hierarchy. They feel that socio-psychological impact (indignation and fear), disruption of everyday life and harm to the democratic constitutional state causes social instability and are therefore particularly serious, as are, in the event of disasters, fatalities, injured, chronically ill, lack of basic necessities of life. The direct economic costs of a disaster are also serious for these citizens (particularly if it hits their own pocket) since a comfortable and pleasurable life is an important goal for A2 people. Long-term harm to the environment and nature is of lesser importance for citizens and policy makers.

Profile B2

The 'hierarchical' perspective – the caring region: This profile represents the outlook of rather traditional and hierarchically-minded citizens who are strongly bound by group and rules. This perspective/world view is that of the more traditional middle class, which want a society with a sense of community on a smaller scale, care for the immediate (social and ecological) environment, in which intangible values play a key role. These citizens feel equality is rather important. Consequences in terms of fatalities, injured, chronically ill, lack of basic necessities of life, long-term harm to the environment and nature, disruption to everyday life, and harm to the democratic constitutional state and the socio-psychological impact (indignation and fear) are regarded as very serious. Encroachment on Dutch territory is seen as rather less serious, unlike harm to the local area, which is indeed seen as serious. B2 people do not consider a comfortable life as very important, which is why economic costs and harm to the international position of the Netherlands in the case of disasters is not seen as serious.

Profile 00

The 'equal weightings' perspective: This profile ascribes an equal relative weight to each of the ten criteria. Citizens and policy makers who are identified within this profile argue that consequences of the same impact level (from A to E) on all criteria is of equal importance (10% of the total).

Appendix B: Literature search results

1. Literature search with keywords (source: Google Scholar)

- Cultural theory and risk perception

- Boholm, A., "Risk perception and social anthropology: Critique of cultural theory" *Ethnos*, Vol. 61, No. 1-2, 1996, pp. 64-84.
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