Many risk scholars recognize the importance of including ethical considerations in risk management. Risk ethics can provide in-depth ethical analysis so that ethical considerations can be part of risk-related decisions, rather than an afterthought to those decisions. In this article, I present a brief sketch of the field of risk ethics. I argue that risk ethics has a bias toward technological hazards, thereby overlooking the risks that stem from natural and semi-natural hazards. In order to make a contribution to the field of risk research, risks ethics should broaden its scope to include natural and semi-natural hazards and develop normative distribution criteria that can support decision making on such hazards.

KEY WORDS: Distribution problem; ethics; natural hazard; responsibility

1. INTRODUCTION

The risk management literature is paying increasing attention to the “ethical aspects” of risk management. The approaches for considering ethical aspects in the management of risks differ, but most authors agree that the decision on the acceptable risk level is ultimately an ethical question that should be left to the political level. Some authors explicitly try to justify specific risk approaches to ethical principles or ethical theories. Other authors discuss risk approaches based on ethical criteria as alternative or additional methods for risk evaluation.

Although this attention to ethical considerations in risk management is certainly to be welcomed, it also seems that the discussion of the ethical considerations is sometimes rather limited. For example, in a paper on “total effect” versus “equity” based risk evaluation methods, the terms “distributive justice,” “equity,” and “equality” are used interchangeably.

The literature on moral and political philosophy discusses more fine-grained conceptions of justice that may be more helpful in making risk-based decisions. Does justice indeed entail that a distribution ought to be equal, or does it suffice to provide people with a threshold level of some good? And what is the “entity” to be distributed? Should it be a particular safety level that is equal for all, or should it be an equal distribution of the scarce resources available for reducing the risks?

Before elaborating on these questions, it should be noted that risk research is a field in which the terminology is far from well established. Aven and Renn compiled a list of different meanings of the term “risk” in the risk literature that, although nonexhaustive, comprised 10 items. The two key dimensions of risk are uncertainties about events and consequences, and the severity of these events and consequences. Aven and Renn identified three properties that a definition of risk should have in order to provide a sound basis for risk research and risk management. It should:

1. be able to accommodate both undesirable and desirable outcomes;
2. address uncertainties rather than probabilities and expected values; and
3. not be restricted to specific consequences and quantities, but should address outcome stakes instead.
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According to Aven and Renn, the first property is important because some outcomes may be considered desirable by one person but undesirable by some other person. In order to reach agreement on risk-related issues, a definition of risk should not be dependent on how we label the consequences. The second and third elements are considered necessary because the probabilities and expected values are conditioned on a number of assumptions and suppositions, which are hidden if consequences are expressed in terms of seemingly precise probabilities, or are restricted to specific consequences and quantities. This reflects the important observation by Aven and Renn that the risk itself does not represent a state of the world, but that the events and consequences are states of the world. On the basis of these three elements, they propose to define risk as the “uncertainty about and severity of the consequences (or outcomes) of an activity with respect to something that humans value” (p. 2). The recognition that the events we are dealing with in risk research are often characterized by uncertainty is certainly a step forward. However, it should be noted that this definition reflects a break with the terminology used in decision theory, where an essential distinction is made between decisions “under risk” and decisions “under uncertainty.” The difference is that in the former case, but not the latter, probabilities are assumed to be known. This distinction dates back to work in the early 20th century by economists J. M. Keynes and F. H. Knight. The definition proposed by Aven and Renn should therefore be seen as referring to situations of decision making under uncertainty and not under risk. As long as we are aware of this difference in definition, it does not seem to be problematic to use this broader definition.

The term “hazard” is commonly used to refer to a potential source of harm. Technologies may be such a source of harm (in which case, we use the term “technological hazard”), but harm may also be caused by naturally occurring events, in which case we use the term “natural hazard.” Examples of the former are nuclear technology, chemical plants, etc. Examples of the latter are earthquakes, volcanic eruptions, drought, storms. It should be noted that the distinction between technological hazards and natural hazards is not an absolute one, and there is no a priori reason to allow lower safety standards for risks caused by natural hazards, or to impose higher standards for risks caused by technological hazards.

This brings us to the third terminological point. In the risk field, it is common to distinguish between risk analysis or risk assessment on the one hand, and risk management or risk treatment on the other. Risk analysis has an ontological component (about the state of the world) and an epistemological component (knowledge about this state of the world). These two components are captured by the definition proposed by Aven and Renn. Risk management is primarily a normative undertaking: What ought to be done, and how safe is “safe enough”?

My starting point is that risk management can benefit from risk ethics. In the current debates in the risk literature, many risk scholars recognize the importance of including ethical considerations. Risk ethicists can provide in-depth ethical analysis so that ethical considerations can be part of risk-related decisions, rather than an afterthought to those decisions. However, risk ethicists should become more familiar with the topics that are being discussed in the risk literature. My claim is that risk ethics is currently so focused on technological risks, that it overlooks risks arising from natural and semi-natural hazards. In order to defend my claim, I present a brief overview of the field of risk ethics, followed by a suggestion for an addition to the research agenda of risk ethics.

2. RISK ETHICS

Risk ethics is a relatively new field in moral philosophy. It grew out of dissatisfaction with the inability of traditional moral theories to deal with risks and uncertain outcomes. Although Robert Nozick is often mentioned as one of the first contemporary philosophers to discuss the ethical issues associated with risks, he was not the first philosopher to point at the moral aspects of risks. Since the 1980s, risk ethics has developed as a separate field, with close links to the ethics of technology.

It is now generally agreed among risk ethicists that risks create unique ethical problems that cannot be satisfactorily analyzed or assessed in terms of familiar concepts in moral philosophy. Moral philosophy has a bias toward deterministic situations in which we know for certain what will happen if we do A rather than B. Traditional ethical theories provide little guidance for situations in which we do not have prior knowledge of the consequences of our actions. That we lack tools for dealing with risk or

1For a more detailed description of the history of risk ethics, see Ref. 12.
uncertainty can be considered a major and fundamental defect in moral philosophy.\textsuperscript{(24)}

Opponents of a separate field of risk ethics might argue that we could leave it to decision theory to translate the moral assessment of well-determined situations into an assessment of rational behavior in real-world indeterministic cases or situations in which there is a lack of knowledge. According to this view, we can use ethical theories to assess deterministic cases. Decision theory can then determine, on the basis of the probabilities of occurrence of the respective options, the most rational choice or action.\textsuperscript{(22)} However, the problem with this division of labor is that decision theory operates exclusively on criteria of rationality, which may, for example, select the action or choice that has the highest expected utility. However, the moral appraisal of situations of risk and uncertainty cannot be determined on the basis of probabilities and utilities alone; it also depends on interpersonal relationships and distributional considerations, such as the question of who introduces a risk or who benefits from it. Moreover, risk does not in itself refer to a state of the world; rather, it refers to a state of the world combined with uncertainty about that state. The transformation of uncertainty and lack of knowledge into probabilities is often not straightforward, or is even impossible.\textsuperscript{(6)} Since many problems related to uncertainty also give rise to ethical problems, the current tools of decision theory are not sufficiently equipped to deal with moral problems of uncertainty and risk (pp. 291–292).\textsuperscript{(22)}

One of the leading philosophers of risk has formulated the guiding question in risk ethics as the following exemption problem:

“It is a prima facie moral right not to be exposed to risk of negative impact, such as damage to one’s health or one’s property, through the action of others. What are the conditions under which this right is overridden, so that someone is allowed to expose other persons to risk?” (p. 303).\textsuperscript{(22)}

This question manifests the main focus of risk ethics: the exposure of people to hazards through the actions of others. This suggests that the field has a strong focus on the introduction of new, often technological, hazards by people. However, not all hazards are man-made. Many are natural hazards, which are not caused by the introduction of new technologies. Although these risks can to some extent be increased or reduced by man-made means (by reducing the hazard or the impact of the consequences, or both), it would be wrong to conceive of risks that arise from natural hazards as something that one person imposes on other people. The answer to the exemption problem that has emerged in the risk ethics literature is therefore not directly applicable to natural hazards.

Before going into detail about the difference between technological and natural hazards, let us first have a closer look at the conditions that have emerged as a potential answer to the exemption problem. In the literature, the following nonexhaustive list of conditions has been proposed.

\textit{Informed consent.} Risks are more acceptable if people consent to being exposed to a hazard.\textsuperscript{(25)} Although this condition has intuitive appeal, it is not unproblematic. If this condition is taken to the extreme, people could rule out virtually any action, which would cause a stalemate when deciding about potential risks \textsuperscript{(26,27)} and might even impose greater risks.\textsuperscript{(28)} In order to overcome a too restrictive attitude toward risks, proposals have been made to offer compensation to those people whose rights have been violated,\textsuperscript{(12,13)} which raises the question of which rights may and which rights may not be violated. Although the absolute right not to be exposed to a hazard without one’s consent is difficult to assure in all situations, it does point to some ethical considerations that should be taken seriously (participation of lay people in decision making about risks, due process rights for compensation, etc.).

\textit{Availability of alternatives and proportionality.} Whether it is acceptable to expose a person to a hazard depends on the availability of alternatives to the action that leads to the exposure (in legal terms: subsidiarity) and whether the benefits gained by the exposure outweigh the disadvantages (proportionality). Taken as single criterion, proportionality resembles the standard procedure in risk management, viz. cost-benefit analysis. However, it is important to look at alternatives as well. In some environmental laws, the notion of “best available technology” (BAT) is used to define a threshold. Those risk levels that are achieved with the best available technologies define the level of what can be considered an acceptable risk level. The \textit{ALARP} principle, which prescribes that risks should be reduced to a level that is “as low as reasonably practicable,” indicates that it matters whether or not the risk can be reduced by using other means. Some risk ethicists refer to “as low as reasonably achievable” (ALARA) as the preferred principle because the ALARP principle is primarily based on utilitarian considerations, whereas ALARA also alludes to socio-ethical considerations.\textsuperscript{(29,30)} In practice, however, the two principles are considered synonymous.\textsuperscript{(31)} Both the
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BAT and the ALARP/ALARA principle leave room for different interpretations, and consequently a different compromise between protection and economic optimization. Although these principles are in need of further clarification, they point to an important moral consideration, namely, that the extent to which alternatives to risk-imposing actions are available matters from a moral point of view.

Justice. Are the people who are exposed to a particular hazard also the ones who gain the benefits from the risk-imposing action? Central to cost-benefit approaches to risk evaluation is that all costs and benefits are expressed in a single measure for assessing the acceptability of particular risk impositions. That means that the costs and benefits that pertain to different individuals are added, without considering the fact that they are bound to different persons. However, the criticism that is commonly leveled at cost-benefit approaches (and consequentialist theories in general) is that it is morally wrong to “simply aggregate costs and benefits to different persons and seek to maximize this aggregate” (p. 99ff). Justice requires that people are treated individually and comparatively. In terms of risks, it would be wrong to accept, without any additional measures, that one person or one group of people is exposed to a hazard, and that some other person or group benefits from the former’s exposure.

Let us now turn to natural hazards and see to what extent these criteria can guide decision making on natural hazards. But before doing so, I shall briefly describe the origin of the field of risk research.

3. NATURAL HAZARDS

Risk research has emerged from two main lines of research that were originally two (more or less) distinct disciplines: natural hazard research and technical safety analysis. In the 1980s, the two disciplines developed into a unified framework. Although the distinction between natural and technological (i.e., nonnatural) hazards is debatable, natural hazard research mainly focused on the social response to natural hazards (cf. Refs. 36, 37, cited in Ref. 34), whereas safety analysis was primarily concerned with the quantification of risks arising from technological activities (cf. Refs. 38–40; cited in Ref. 34). The current risk literature treats both natural and technological hazards.

As explained in the previous section, the focus in risk ethics is on hazards imposed by new technologies. Surprisingly little attention is paid to natural hazards, and when they are discussed, it is primarily in relation to technology. Natural hazards are then used as threshold levels for deciding on the acceptable risk level imposed by technologies. In radiation risk management, for example, some people argue for the use of the background radiation (i.e., the “natural” radiation level) as the threshold level below which no further regulation for radiation is needed. However, most risk ethicists consider background radiation an inadequate indicator of the acceptable radiation level.

The management of risks arising from natural hazards is more of a distribution problem than a risk imposition problem. Although it is recognized in risk management that many risks can be neither reduced nor enhanced, but only transferred, risk ethics seems primarily concerned with the question under which conditions particular hazards can be introduced (be it as a risk to people or to the environment). This question does not capture all the relevant issues in risk research. If we look at flooding, as an example of a natural hazard, the moral question does not seem to be under which conditions we allow flooding in our society, but what we consider an acceptable risk level and to what extent we accept differentiation in risk levels for different people or in different areas. In flood risk management, for example, the question of norm differentiation is currently one of the most pressing questions. The implementation of preventive measures in one area often increases the risk level in other areas. Additionally, the question how to implement preventive measures also has a distributive aspect, especially in densely populated areas.

If we look at the criteria discussed in Section 2, we see that these provide little guidance on how to decide on these distributive questions. The criterion of informed consent, for example, is notoriously difficult to apply to collective risks, and risks arising from natural hazards are, without exception, collective risks. The extent to which alternatives are available may be a suitable criterion for deciding between different risk-reduction strategies, but less so for deciding on the acceptable risk level. Also the criterion of proportionality—that is, whether the benefits gained outweigh the disadvantages—is of little help when deciding about a redistribution of risks in a situation in which the sum of all the risks remains the same. Justice, as the remaining criterion, seems the most suitable criterion for deciding about natural hazards.
Admittedly, flooding is not a strictly natural hazard and, by using technological means, we can to some extent reduce the risk of flooding without transferring these risks to other areas. But to treat these and other semi-natural hazards as newly imposed hazards probably does not provide the best starting point for addressing the ethical questions.

Treating natural hazards as a distribution problem yields the following three questions:

(1) If we accept that the ethical aspects involved in natural hazards entail a distribution problem, what is the entity to be distributed? This question is far from trivial. If we say that we want a distribution to be fair or just, an intuitive answer would be to distribute the risks (in the sense of probability times consequences) in a fair way. However, if we recognize that risk cannot be seen as representing a state of the world, the distribution of risks may be problematic and it may be better to focus instead on the fair distribution of vulnerability (i.e., the impact of the event if the event actually occurs). After all, it is the impact that counts. The drawback is that both the distribution of risks and the distribution of vulnerabilities are dependent on numbers that are uncertain. The question as to the entity to be distributed has a parallel in political philosophy, namely, the “Equality of what?” question. Borrowing from this discussion, it could be argued that we should focus less on quantitative measures or the distribution of resources, and more on people’s ability to survive if an event actually occurs. The concept of “human capability” used in political philosophy may provide a useful starting point. It refers to the ability of people to lead the lives they have reason to value, like being in good health, having access to education, and being able to establish personal relationships. What people have reason to value may vary from person to person and it therefore requires a more context-specific risk evaluation, but this approach emphasizes that we should look beyond the mere provision of basic resources, and that we should also look at how people are able to shape their lives. This capability approach seems consistent with the definition provided by Aven and Renn, which explicitly goes beyond specific consequences and quantities. It has recently been proposed as a suitable measure for assessing and evaluating societal risks.

(2) If we know the entity to be distributed (be it the risk, vulnerability, precautionary measure, or human capability), the question is what a fair or just distribution amounts to. Should it be equal for all, or should some threshold level be secured for everyone, with the possibility of differentiation between risk levels below this maximum risk level? Or should we perhaps focus on the people who are worse off and give them priority? These are questions that are typically discussed in political philosophy, but the focus in political philosophy is mostly on the distribution of positive goods. Insights from political philosophy should be translated to the context of risks and hazards. One of the challenges will be to account for different attitudes toward risks (i.e., risk-averse or risk-seeking behavior) and the way people want to shape their lives.

(3) The third question relates to the distribution of responsibilities. With risks increasingly managed in a “governance” framework, how should the responsibilities be distributed among the actors involved? In today’s society, safety is no longer the sole responsibility of central government. This means that private parties as well as regional and local governmental bodies become involved. Do these actors have a say in how risk management policy is shaped, or are they actually given a specific role in the mitigation of risks? Additionally, many natural hazards are not confined to one area or one country. This means that there is also a trans-boundary distribution of responsibilities. Flooding is a paradigmatic example in this regard: river works affect the probability of flooding downstream. How responsibilities for preventive measures should be distributed between neighboring countries is one of the pressing questions that must be answered in the coming years. These are questions that risk ethics cannot ignore.

4. CONCLUDING REMARKS

In this article, I presented a brief sketch of the field of risk ethics. I argued that risk ethics has a bias toward technological hazards and overlooks natural and semi-natural hazards. In order to make a contribution to the field of risk research, risk
ethicists should broaden their scope to include natural hazards and develop normative distribution criteria that can support decision making on such hazards. The advantage of treating natural hazards as a distribution problem is twofold. This approach seems to be more in line not only with the discussion of natural hazards in the risk literature, but also with the ethical issues involved. The definition of risk proposed by Aven and Renn seems to provide a good basis for addressing the ethical aspects of natural hazards. It avoids the pitfall of treating risks as a state of the world and limiting the impact to specific consequences, thereby creating room for different approaches to the three distributive questions identified in this article.

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