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PERSPECTIVE

Cases of real-life policies related to risk: How can they enhance risk analysis and risk science?

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Abstract

Policies on risk constitute a core topic of risk analysis and risk science, and it is common at risk conferences to present real-life cases of such policies, for example related to the handling of climate change and pandemics. Although these are of broad interest, showing how important issues in society are dealt with, it can be questioned to what extent and how these cases contribute to enhancing risk analysis and risk science. The present paper addresses this concern. It is argued that, in order to learn from the cases, they need in general to be more thoroughly followed up with discussions of concepts, principles, approaches, and methods for assessing, characterizing, communicating and handling risk. Describing a governmental policy on, for example, the handling of COVID-19 is a point of departure for interesting discussions concerning its justification and performance, in particular in relation to risk and the most updated knowledge from the risk analysis field. Such discussions are, however, often lacking. The paper points to some key obstacles and challenges for the learning process, including the difficulty of distinguishing between policies, policy analysis, and politics.

KEYWORDS
policies on risk, policy analysis, risk science

1 | INTRODUCTION

At the SRA (Society for Risk Analysis) Annual Meeting, it has been a tradition to include plenary speakers, presenting and discussing policies concerning societal issues in relation to, for example, technological advances, pollution, climate change, health, and human trafficking. These speakers provide insights about real-life policies, for example on how the COVID-19 pandemic has been handled in a specific country and how governments and the world approach the climate-change challenge. Although it is common to relate the discussions to risk analysis, the degree to which this is actually done varies considerably. Having listened to numerous talks of this type over many years, it is the present author's assessment that, in most cases, it is to the actual policies that most attention is devoted, not risk analysis or risk science with their concepts, principles, approaches, methods, and models. If risk analysis and risk science were the focus, the really interesting discussions for the risk analysis community would address questions about the justification and performance of the policies adopted, in particular in relation to risk and the most updated knowledge from the risk analysis field. However, such discussions are often not included.

This observation is a main motivation for the present paper. The SRA annual meeting plenary talks have been used to illustrate the challenge. More generally, the paper is based on the conviction that the risk analysis community can benefit from a stronger risk science follow-up of discussions of actual policies on risk at conferences, seminars, and in scientific writing. Key questions that need to be asked are: What characterizes the risk policies when it comes to conceptualization, description, communication, and handling of the risks? How does it compare with risk science knowledge?

The present paper aims to demonstrate, by reasoning and examples, that such follow-up discussions can add important risk analysis insights. When referring to "risk analysis," the SRA tradition is adopted, meaning all aspects and activities of risk, that is, risk assessment, risk

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characterization, risk communication, risk management, and policy relating to risk (SRA, 2015). The follow-up discussions relate to concepts, tools, and issues like the precautionary principle, cost-benefit analysis, science, knowledge, and uncertainties.

The above discussion must not be interpreted to mean that little or no research has been conducted on the relationship between risk analysis and policies (including policy analysis and policy-making processes). A large number of authors, many associated with SRA, have made important contributions: Baruch Fischhoff, John Graham, Ragnar Löfstedt, Ortwin Renn, and Jonathan B. Wiener (e.g., Fischhoff & Kadvany, 2011; Fischhoff et al., 1981; Graham & Wiener, 1995; Löfstedt, 2014; Renn, 2008; Wiener, 2020), to mention a few. The point made in the present paper is, however, that more can be done to enhance the interrelationship between risk and policy, particularly in relation to discussions on real-life policies.

The paper is organized as follows. First, in Section 2, the terms "policy," "policy on risk," and "policy analysis" are looked into, particularly what is meant by a good policy. Building on this basis, Section 3 discusses the relationship between policies and policy analysis, on the one hand, and risk policies and risk analysis (risk science), on the other, particularly how to improve the risk analysis and risk science learning by studying actual, real-life policies on risk. Finally, Section 4 provides some conclusions.

2 | SOME BASIC DEFINITIONS AND THEORY ABOUT POLICY AND POLICY ANALYSIS

In general terms, a policy can be defined as a set of ideas, a principle, or plan for what to do in a particular situation to achieve desirable outcomes. It applies to international organizations, governments, private sector organizations and groups, as well as individuals, although it is most commonly used for groups of people, organizations, and governments that have officially agreed on a principle or plan. As an example, think about the German energy policy following the Fukushima accident in Japan in 2011: to significantly reduce CO_2 emissions, to substitute renewable energy for fossil fuel, to phase out nuclear energy, and to increase the efficiency of electricity generation (Wagner, 2012). The policy expresses how the government is thinking in relation to energy in future years in Germany, what their basic ideas and plans are. The policy relates to risk in many ways; for example, the risk from a nuclear power plant accident is reduced. The phasing-out of the nuclear energy can be seen as a result of a concern about the safety and security risks related to this industry. However, the policy could lead to an increase in the risks associated with energy shortfalls, at least for some years and certain periods. Risk assessments studying the policy implications would address such issues. It would, however, not be accurate to speak about a "policy on risk," as the policy is primarily about energy.

As another example, think about a country's policy on handling the COVID-19 disease, which says that preschools and schools (for children up to age 15) should, to the greatest extent possible, be open. This policy is mainly about education and health and thus has a strong safety risk component. Considerable research has been conducted to study the effect of this policy on risks and children's health (e.g., Axelsson, 2021; Ludvigsson et al., 2021).

As the third example, consider the use of the precautionary principle in European Union (EU) environmental law (Delogu, 2016; EU, 2022). This principle is to be included in EU policies on different types of environmental applications, but it can also be seen as a policy on risk, guiding the risk handling. Analogously, an enterprise may define a policy on risk, and particularly the risk handling, by referring to contemporary risk science defined, for example, by relevant SRA documents (SRA, 2015, 2017a, 2017b) and related scientific literature.

A policy can be viewed as an authoritative choice by the government or leadership making their mark—typically expressed as an authoritative statement (I)—based on some understanding (hypotheses, theories, models) of the world (II), with the aim of achieving some objectives (III) or being in line with some values (for example, democratic principles) (Althaus et al., 2018). Science is a main source for II. Consider, for example, the above COVID-19 example. The policy is based on knowledge of the relevant phenomena and cause–effect relationships, particularly the consequences of having open/closed schools with different types of operating rules. This knowledge also needs to reflect uncertainties and risks.

The presentation of the examples considered above covers (I) but not (II) and (III), except for the German energy policy, which also expresses goals by, for instance, stating that its aim is "to significantly reduce CO_2-emissions."

A policy analysis supports the development of policies. It assesses and compares the performance of one or more alternatives (potential or existing) in relation to relevant expectations and objectives (Althaus et al., 2018; Morgan, 2017; Weimer & Vining, 2017). A policy analysis combines (II) and (III) to help establish (I). Basic assessment tools include cost-benefit type of analysis, expected utility theory, multi-attribute analysis and risk and uncertainty analysis. The criteria adopted for making judgments about the performance of the policy depend on the type of applications. Common criteria used are related to effectiveness, unintended effects, costs, risks, feasibility, and acceptability.

Science and knowledge-generating assessments are the main input to the policy analysis, and policymakers use the policy analysis, together with political/management input, to develop a suitable policy, as shown in Figure 1.

Morgan and Henrion (1990) present a set of "10 commandments" for a good policy: (1) do your homework with literature, experts, and users, (2) let the problem drive the analysis, (3) make the analysis as simple as possible, but not simpler, (4) identify all significant assumptions, (5) be explicit about

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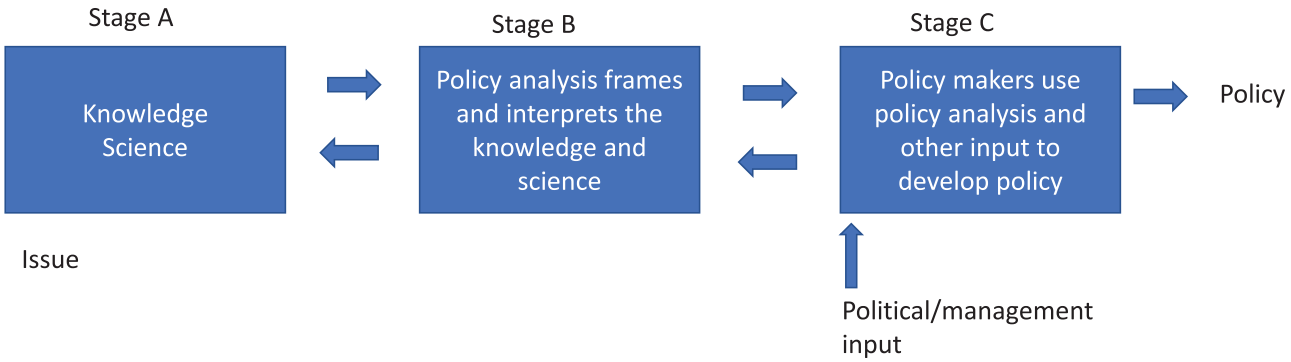

FIGURE 1 A model to show the link between science (knowledge), policy analysis and the policymakers' development of a policy (based on Granger Morgan, 2017)

decision criteria and policy strategies, (6) be explicit about uncertainties, (7) perform systematic sensitivity and uncertainty analysis, (8) iteratively refine the problem statement and the analysis, (9) document clearly and completely and (10) expose the work to peer review.

This is just an example of principles and guidance for how to conduct good (high quality) policy analysis. As all other scientific fields, the policy analysis field, with its journals, researchers, books, papers, and societies, continuously produces enhanced knowledge on topics within its scope. This particularly includes issues related to the assessment and communication of policies.

When developing and using policies, policymakers commonly refer to the policy circle—similar to the quality circle (plan, do, check, act)—covering stages such as problem identification (agenda setting), identification of alternatives and assessments, policy formulation, decision making, implementation, evaluation, reconsiderations, and possible return to agenda setting (e.g., Althaus et al., 2018; Jann & Wegrich, 2007). The circle has been strongly criticized in terms of both theoretical justification and empirical validity; nonetheless, policy research continues to build on the cycle or stages of the cycle (Jann & Wegrich, 2007).

Intuitively, a good policy is one that produces desirable outcomes. The problem with this idea is of course that the outcomes are unknown and uncertain at the point of decision making. Thus, we need to base the conclusions on the processes implemented to develop and use policies, for example ensuring that a high-quality policy analysis and cycle is implemented. The aim is to make an authoritative choice, based on strong understanding of the related phenomena, meeting the objectives.

When it comes to policies on risk, the risk science provides the most updated and justified knowledge on principles, approaches, and methods for how to understand, assess, characterize, communicate, and handle risk (Aven, 2018; Aven & Zio, 2014; SRA, 2015, 2017b). As a concrete illustration of what such knowledge covers, reference is made to the paper of Aven and Renn (2018), which summarizes and discusses fundamental principles that a government may adopt in relation to risk.

Using this section as a basis, we will in the following discuss issues related to policies and risks, following up the points made in the introduction section.

3 | DISCUSSION

To illustrate this discussion, consider the policy of handling the COVID-19 disease and, to be concrete, the specific policy referred to in Section 2, adopted in a specific country, which expresses that preschools and schools (for children up to age 15) should, to the greatest extent possible, be open. A policy analysis in relation to this case would seek to assess—relative to a closing policy—for example, its feasibility; effects—academically, socially, and mentally; health risks; and acceptability. In the early stages of the pandemic, the uncertainties were large, but since then considerable knowledge has been developed, providing input to the analysis. Science did not allow clear answers in spring 2020, yet some basic knowledge existed on phenomena and processes related to similar viruses and from previous epidemics and pandemics. Policy analysis frames and interprets this knowledge, refer to Figure 1, reflecting various scientific perspectives and understandings, leading to different suggestions for which policy to adopt.

3.1 | The concepts of risk and risk analysis are fundamental for policy analysis

To see how risk analysis and risk science relate to this policy analysis, we first need to clarify the risks that are important. One can argue that the policy analysis is to a large extent a risk assessment, as what is of main interest is the future implications, effects, and outcomes of the policy (i), and these implications, effects, and outcomes are subject to uncertainties (ii). Following contemporary risk science (SRA, 2015, 2017b), these two features define risk: the consequences C (implications, effects, and outcomes) of the policy and the associated uncertainties U, for short denoted (C,U).

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Risk science provides the most updated and justified knowledge on how to understand, assess, characterize, communicate, and handle risk. Hence, it is clear that policy analysis has the potential to strongly benefit from risk analysis and risk science, for example from insights about how people perceive risks, as well as guiding principles on how to describe and communicate risk. If we review current practices in different countries concerning the conceptualization and characterization of pandemic risks, we see considerable differences—nomenclature and principles to varying degrees in line with state-of-the art risk science as defined in the present paper (Glette-Iversen et al., 2022). To be concrete, think about the common practice in both policy and risk analysis of using risk matrices to present and communicate risk and even considering risk as the product of probability and loss. Risk science warns against this practice, as it can seriously misrepresent risk and misguide decisionmakers, and alternatives exist (e.g., Aven & Cox, 2016; Aven & Thekdi, 2022; SRA, 2015, 2017b). Risk science, however, not only provides input on current methods for risk descriptions, it also stimulates further developments. Risk science is the practice that seeks to enhance the way we should understand, assess, communicate, and handle risk.

As an illustration of this discussion related to the risk handling, think about the precautionary principle. This principle is controversial, and many policy analysts and decisionmakers struggle to understand and use it. Common criticism of the principle expresses that it is paralyzing, unscientific, and promotes a culture of irrational fear (e.g., Rechnitzer, 2020). Risk science as interpreted in this paper refutes such claims (Aven, 2020; Hansson, 2020; Rechnitzer, 2020). If the principle is invoked only in cases when facing the potential for serious consequences subject to scientific uncertainties, it can indeed be justified as a guiding protection principle. Countries gave weight to the precautionary principle in March 2020 when facing the coronavirus threat, and most countries implemented strong measures to shut down social life. Science could not then provide clear answers. Today, the knowledge is stronger, and the potential use of lockdowns and school closure is not about applying the precautionary principle interpreted in this way.

From a policy and policy analysis point of view, it is interesting to examine and describe in detail the policy, what it expresses, its motivation and effects (consequences) C. From a risk and risk analysis perspective, the uncertainties in relation to C have a main focus. Following Morgan and Henrion's (1990) "ten commandments" for a good policy, uncertainties are also of importance and highlighted in policy analysis but in practice often not very thoroughly and not in line with current risk science knowledge. These are general observations made by the present author and can of course be discussed. To support the assertion, consider, for example, the common practice of using cost-benefit type of analysis to compare alternatives. This type of analysis is to a large extent based on expected values and, hence, underrepresents risk and uncertainties (Aven & Thekdi, 2022). Another example relates to the common practice of characterizing uncertainties and risk using probabilities, without including judgments of the strength of knowledge supporting the probability calculations and assignments (Flage et al., 2014).

3.2 | When discussing real-life policies, we need to more strongly address risk science issues

This type of criticism of policy analysis can be raised against nearly any sort of applications. Risk analysis (risk science) is just one input among many, and one cannot expect the application (here, policy analysis) to be fully updated on the latest insights from all other input disciplines. However, the interest that we find in the risk analysis community in policies in general and policy analysis in particular, provides an opportunity for interesting discussions about the risk-related principles, approaches, methods, and models used on policy-related issues. When policies like those outlined above in Section 2 are discussed in risk forums, for example at conferences and meetings, we need to address risk science issues in more depth than commonly seen today. We need to question how the country expresses risks related to COVID-19, compare different countries' approaches and relate these to contemporary risk science guidelines. We need to clarify the use of the precautionary principle in relation to the pandemic, its meaning, and justification. From a risk analysis and risk science perspective, our main interests are the principles, approaches, methods, and models for understanding, assessing, characterizing, communicating, and handling the risks, and not the policies as such. We can discuss energy issues and policies using numerous perspectives and drawing knowledge from many fields and disciplines, but if we do not relate these to risk, they are outside the scope of risk analysis and risk science. Some of us in the risk analysis community could be health experts, but we meet at such forums because we share a common interest in risk analysis and risk science, and not particularly in health or any other area of application. Our goal is to share and enhance the knowledge across domains, to benefit all application areas. This means using current policies as points of departure for our discussions on how risk is analyzed (assessed, communicated, handled) and what we can do to improve the analyses.

Risk analysis provides important input to policy analysis, as argued above, but the level to which our field and science are really influential in the way policy analysis conceptualizes, assesses, communicates, and handles risks is open to discussion. Do policymakers look for risk science guidance? Think about the COVID-19 pandemic. Have health agencies and experts referred to risk science knowledge when communicating with the public? To a limited degree, it seems. The reason is that risk analysis and risk science are still not really recognized as an essential knowledge source. The challenge of strengthening the risk science input in applications is thus a broader question than just improving specific policy analyses. A broad set of initiatives and measures are needed (see

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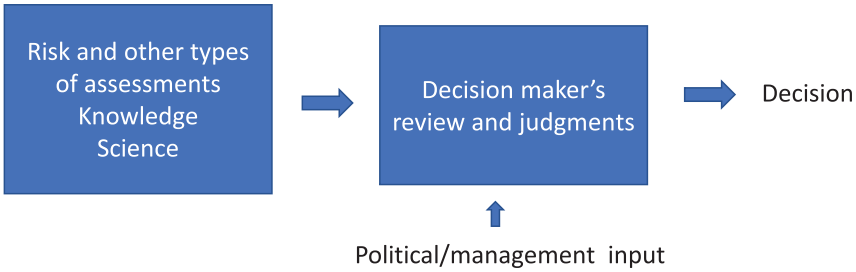

FIGURE 2 Model of the risk management process using risk assessments and other analyses to support decision making (based on Hertz & Thomas, 1983, see also Aven & Thekdi, 2022)

also Aven, 2018), including the establishment of risk science guidelines directed at various topics and application areas, particularly in relation to policy analysis. SRA has developed some generic high level documents on terminology and fundamental principles (SRA, 2015, 2017a, 2017b), but more applied guidance is also strongly needed. Standards exist in most areas, but they are not science based; refer to the discussion in Aven and Ylönen (2019).

3.3 | The different stages of the policy process

Referring to Figure 1, a policy analysis can be scientific and neutral, in the sense that it is conducted according to the best knowledge available from the field of policy analysis, covering concepts, principles, approaches, methods, and models for understanding, assessing, characterizing, and communicating the "goodness" (performance, quality) of policies. When integrating managerial and political input and considerations, and a policy is to be recommended/selected, fundamental scientific principles—as summarized, for example, by Hansson and Aven (2014)—can no longer be met. When, for example, concluding that a policy is unacceptable because of its effect on the environment or because it has a too high accident risk, the logic is not based on science but management and politics.

Governmental agencies typically have a foot in both stages B and C of Figure 1: they conduct policy analyses as explained above, but making clear recommendations for the government cannot be done without making value judgments that extend beyond scientific analysis. Returning to the above open school example, a specific recommendation of a health agency would involve balancing different concerns, clearly implying considerations that are based to some degree on values and priorities.

The risk analysis literature includes similar discussions, highlighting the importance of broad risk evaluations—often referred to as "managerial review and judgment" or "decision maker's review and judgments" (DRJ)—bridging the gap between science and knowledge, on the one hand, and decisions, on the other (e.g., Hansson & Aven, 2014; Hertz & Thomas, 1983; Renn, 2008; Rosa, 1998; Shrader-Frechette, 1991; SRA, 2017b); see Figure 2. The DRJ is formally defined as the process of summarizing, interpreting, and deliberating over the results of risk assessments and other assessments, as well as of other relevant issues (not covered by the assessments), in order to make a decision (Aven & Thekdi, 2022). The DRJ is justified by the fact that all assessments have limitations—there are uncertainties and not all aspects relevant to the decision makers are fully captured by the assessments. The knowledge is not objective facts but justified beliefs, often based on critical assumptions. The decision making needs to take into account stakeholders' values, goals, criteria, and preferences—we may all agree on the science but disagree on what is the best policy and decision.

Discussing the borderlines between the different stages of the policy processes is important for clarifying and understanding how science and policy interact. The idea that assessments and science prescribe what is the proper decision is commonly seen in practice, when referring to policies that are risk-based or science-based, basically ignoring the DRJ. Consistent with the models of Figures 1 and 2, the policies are risk-informed and science-informed, with the DRJ as an essential stage of the decision-making process (Apostolakis, 2004; Aven & Thekdi, 2022).

3.4 | The importance of making a clear distinction between analysis/science and management/politics

Having attended a number of risk analysis conferences, it is the author's impression that there is a trend of more risk analysts and scientists taking a clear stand on policy issues. From its inception, SRA has had a policy of no policy, in the sense that the Society does not have an official view on political issues, acknowledging that its members have different views on such matters. The Society builds its activities and works on some statements about values/ethics, and it supports in general efforts to strengthen the role of science in society, but no official SRA views are expressed on, for example, the handling of the COVID-19 pandemic or the use of nuclear power plants. What unifies members of SRA is risk analysis and risk science, that is, the search for improved knowledge on concepts, principles, approaches, methods, and models for understanding, assessing, characterizing, communicating, and handling risks. As for any science, it should be politically neutral, yet it can be used for different political purposes. Risk analysis can play an important role in confronting serious risks, such as climate change and epidemics, as a science, approach,

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and analysis tool. Everybody is welcome to apply risk analysis; what risk science is concerned with is the scientific risk-related knowledge. SRA is and should be a society where this is the focus.

There are always situations challenging the borderline between science and politics/management. Think about a hypothetical case in which we are faced with a global serious threat where the vast majority of the worlds' scientists agree on what is the problem and that strong actions are needed. Should risk science and societies like SRA then not mobilize and make efforts to support such actions and policies that could lead to proper measures being implemented?

No, is the present author's clear answer. One can use ethical arguments to support actions, but the need for actions does not conflict with the objective of maintaining risk analysis and organizations like SRA as truly science based. The moment risk analysis and SRA become blurred about the separation between risk science and politics, their role as knowledge bases on risk analysis would be destroyed. How can we trust a field and a society on scientific issues, when there are potentially underlying political stands influencing the recommendations provided?

Scientific processes are also subjective and dependent on values; for example, recommendations are provided on state-of-the art definitions of key concepts. However, the scientific processes follow some common standards for review, and there is a continuous discussion—battle—on what the current most justified knowledge is. Different scholars and "schools of thought" argue for their perspectives and beliefs (Bourdieu & Wacquant, 1992). This debate differs completely from mixing science and politics/management issues.

4 | CONCLUSIONS

Studying cases of real-life policies related to risk can be useful for enhancing risk analysis and risk science, provided that a risk analysis and science perspective is adopted. Such a perspective means that the cases are scrutinized with respect to concepts, principles, approaches, methods, and models for understanding, assessing, characterizing, communicating, and handling risks. To study the policies from such a perspective, it is recommended that relevant conducted policy analyses are reviewed and a clear distinction made between the various stages of the policy process, as shown in Figure 1. Then, all aspects of risk in relation to the policy analysis should be considered. Often, aspects of risk are made explicit in performance criteria or attributes of the policy analysis, for example related to safety or security concerns, but risk is also relevant when it comes to other performance attributes, as they involve effects (consequences) and uncertainties, the two main features of risk (SRA, 2015).

Following this perspective on risk, risk analysis and risk science provide essential input on policy analysis. All uncertainties in relation to the future performance and effects of the policies are about risk. Studying cases of real-life policies, we need to question, for example, the extent to which the uncertainties have been properly treated—more generally that the best risk science knowledge has been adopted. The paper has argued that, currently, risk analysis and risk science are not visible and strong enough to really have a significant impact on policy analysis. The way forward is to further enhance risk analysis, as a science and a useful practical approach, but also to make efforts to improve the interactions and dialogue between policy analysis and risk analysis. SRA is an excellent arena for such processes. To follow up plenary speakers at SRA conferences addressing policy issues, the common practice should be panels—also plenary—of risk scientists that respond to and discuss the policies in relation to risk science. We have seen some examples of such panels in previous meetings, but many more are needed.

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