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Perspectives on the nexus between good risk communication and high scientific risk analysis quality

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A B S T R A C T

In general, successful risk communication can be said to require "an understanding of the target audience, including the best means for reaching the audience: a credible or trusted source; and a message that has ideally been pre-tested to ensure its effectiveness" [43]. The scientific quality of the risk analysis is not questioned. The sources can be credible or trusted, but the scientific risk analysis quality can be poor. For example, the risk communication can be based on a scientifically unsound risk characterisation, yet be communicated successfully if the reference is a communication perspective as above. Good risk communication cannot, however, be seen in isolation from the broader process of risk analysis and management. The present paper provides some reflections on this topic, the main aim being to strengthen the argumentation for the thesis that scientific and foundational issues of risk analysis are critical for the successful communication of risk. Several examples are used to demonstrate this thesis.

1. Introduction

Think about a hypothetical case, where a risk assessment for a process plant is conducted by a recognised consulting company and the results are communicated to the public and the decision-maker. A key result is that the risk – expressed as a computed probability – is found acceptable, according to some defined criteria. The activity studied is judged to be safe. Dialogue and interaction among all relevant stakeholders are also conducted. All parties, including the decision-maker, consider the consultancy company to be a highly credible and trusted source and conclude from this that they have been adequately risk informed and the risk communication process has been solid and positive in all respects. All involved perceive the communication as successful.

As another example, consider the current risk and threat level characterisations in relation to security issues; see for example [44,34]. People are informed by the authorities that the threat level is low, the reference being a low-judged likelihood. It is probable that the police security services have a good basis for their judgements, and it can thus be argued that the risk communication is successful – people are adequately informed.

But are these perceptions and judgements really enough to conclude that the risk communication is successful? No the present paper argues; successful risk communication cannot be seen as separate from the scientific quality of the risk assessments and the risk characterisations. It is necessary to question the extent to which the risk assessment and the risk characterisation are in line with the scientific knowledge generated by the risk analysis field. Here, risk analysis is used in a broad sense, as done by the Society for Risk Analysis (SRA) since 1980, to include risk assessment, risk characterisation, risk communication, risk management, and policy relating to risk [41]. There will always be discussions about what is the current risk analysis scientific knowledge, yet it is important to acknowledge that some quality references exist that extend beyond individual perceptions. The analysis group members may be confident that they are applying appropriate risk analysis concepts, approaches, principles and methods, but this does not mean that this is in fact the case, as the reference is the risk analysis science.

For example, in the security example, it can be argued that risk communication based on likelihood judgement alone can mislead the public. The problem is that the strength of the knowledge supporting the judgement is not really covered by the likelihood judgements used to characterise and communicate the risk level, as will be thoroughly discussed in the coming sections of this paper.

As another example, consider climate-change-related risk and the associated risk communication of the Intergovernmental Panel on Climate Change (IPCC). For many people, the IPCC is indeed a credible and trusted source. Based on thorough analysis, involving a number of scientists, the IPCC has produced extensive characterisations of climate-change-related risk and uncertainties. However, from a risk analysis perspective, it can be argued that this risk communication is poor in many ways [8]. For example, the IPCC uses the likelihood/probability concept to express important findings, for instance that it is extremely likely (at least 95% probability) that most of the global warming trend is a result of human activities [20]. The IPCC does not, however, provide a clear understandable interpretation of the likelihood/probability concept. The consequences are that people read this type of statement in different ways and have difficulties in understanding what the

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probability really expresses: does it reflect fundamental variation in physical phenomena, differences in expert judgements, different views about specific issues or something else?

If we read the media interpreting the IPCC work, the impression is that the IPCC expresses that science states that global warming takes place and is a result of human activities; the uncertainties are very small and can be basically ignored: the experts are confident that the statements referred to are true. However, the IPCC reports stress that likelihood and confidence statements should not be mixed ("confidence should not be interpreted probabilistically" [19]). The 95% probability statement is of course also related to confidence, but the IPCC reports seem to indicate that this is not the case. Thus, a deeper look at the IPCC platform on risk and uncertainty reveals that the analysis has some serious weaknesses. Acknowledging these, can we still argue that the risk communication is successful?

Clearly, what successful means depends on what the reference is. The issue has been thoroughly discussed in the risk communication literature (e.g. [12,13,23,24,28,37,38,46]). Examples of risk communication objectives include: enlightenment function, right-to-know function, attitude change function, legitimation function, risk reduction function, behavioural change function, emergency preparedness function, public involvement function and participation function [38]. Increasing trust and credibility is often seen as a key objective of the risk communication, and trust and credibility are also prerequisites for many other objectives [38]. Trust and credibility depend on factors like perceived competence, objectivity (lack of biases in information as perceived by others), fairness (acknowledgement and adequate representation of all relevant points of view), consistency (predictability of arguments and behaviour based on past experience and previous communication efforts) and faith (perception of 'good will' in composing information) [38]. It is expected that the communicator conveys accurate, objective, and complete information.

There is, however, a potential gap between what is perceived as competence, objectivity, etc. and what the scientific field claims. In the above examples, the sources may be viewed as trusted and credible, yet the risk communication can be considered unsuccessful from a risk analysis perspective.

The present paper discusses this issue, the nexus between risk communication and the scientific quality of the risk analysis. Risk communication is understood as exchange or sharing of risk-related data, information and knowledge between and among different target groups (such as regulators, stakeholders, consumers, media, general public) [41,42]. The main aims are to achieve increased awareness of this issue, as it is considered under-focused on today, as well as to obtain new insights on risk communication's dependencies on the scientific and foundational issues of risk analysis. The paper is based on the conviction that current risk analysis practice is subject to many weaknesses of a conceptual and fundamental character, which have severe implications for the quality of the risk communication and risk management, as indicated by the above examples. Probability is a key concept in risk and uncertainty analysis, but lack of precision in the understanding and use of this concept hampers risk communication and management in many situations.

This discussion is not new. As commented by one of the reviewers of the original version of the present paper, the issue has been discussed since the time of the Rasmussen report on nuclear power [31]. A basic reference is the book 'Improving risk communication' developed by a Committee on Risk Perception and Communication of the US National Research Council [30], which provides a thorough discussion of what successful risk communication means. See also the excellent review papers by Bier [9,10]. In Europe we find similar discussions, see for example [35,36]. The issue was highlighted in the 90s in relation to the implementation of the Seveso-directive for industrial plants [39]. Some relevant references are [1,25,26,17], see also HSE [18]. A major concern was the quality of the risk assessments submitted to the authorities. As commented by this reviewer alternative solutions were considered, including use of accredited risk analysts and risk assessment standardisation.

The risk analysis field has developed considerably since then, and the present paper aims at performing an updated evaluation of the issue. As such it will provide new insights by highlighting what can be seen as current perspectives on risk and risk analysis. Compared to earlier works on the issue, the paper seeks to dive deeper into the fundamental features of risk analysis, not only risk assessment but all aspects of risk analysis as here defined. As requested by the reviewer, some reflections will also be made on the SRA principles: is it more likely that these will be more effective in influencing the field and in particular the risk communication than guidance provided by earlier attempts? See Section 3.4.

As discussed above, scientific quality is to varying degree addressed when the issue is how to perform successful risk communication. This does not mean, however, that scientific quality of the risk analysis, and in particular the risk assessments, is not addressed in many contexts. As commented by one of the reviewers of the original version of this paper, the quality of the assessment quickly becomes an issue among the stakeholders when the results of an assessment do not support their preferred course of future developments. It will then be a main goal to undermine the position of the opposite party. By making the quality and the science the subject, the discussion is placed in the realm of the scientists, away from the political arena. As long as "the scientists are discussing" there is no reason for the politicians to go into the intrinsically political aspects of their decision and thus show their hands.

The remainder of the paper is organised as follows. In Section 2 we review briefly what good (prudent) risk analysis is, as a basis for discussing what we mean by scientific quality. Section 3 provides the main contribution of the paper and discusses why scientific risk analysis quality is essential for ensuring good risk communication. The above examples are used to illustrate the discussions. These examples reflect the focus and interest of the author. They are of a fundamental character relevant for many types of applications. Finally, Section 4 presents some conclusions.

2. What is good risk analysis?

It is possible to formulate a set of principles which define what is good or prudent risk analysis. These principles can be seen as constituting the most warranted statements or justified beliefs that the risk analysis knowledge field can produce. The perspective is inspired by the understanding of science defined by Hansson [15]. This knowledge field is built on the totality of relevant educational programmes, journals, papers, researchers, research groups and societies, etc., addressing risk analysis. What are the most warranted statements (justified beliefs) is always an issue. There is a continuous 'battle' in respect of what these statements are – it is about institutions and power. Different directions and schools of thought argue for their beliefs, trying to gain control over the field [11].

For risk analysis, considerable work exists that provides input to this 'battle'. Every paper in a risk analysis journal that argues for the use of a specific concept, theory, principle, approach, method or model represents a contribution to this discussion of what the most warranted statements are. A specific scientific paper can be very influential for the field, such as Kaplan and Garrick's [22] paper, which provides recommendations on how to quantify risk. There are also many books that have had and are having a great impact on current understanding of what prudent risk analysis is. Examples include the monographs by Renn [37] and Haimes [14]. However, the impact is typically larger if a group of people – originating from different environments, such as standardisation organisations or societies – can derive some recommendations. As two examples, consider the ISO 31000 Guidelines for risk management [21] and the SRA document on risk analysis principles [43].

ISO [21] is developed in accordance with the ISO process, which