

[SPEAKER_01]

Welcome to this podcast on fundamental issues in risk science.

Today, the topic is rebutting - it means responding and arguing against - some common ideas about risk with Professor Terje Aven.

Welcome.

[SPEAKER_02]

Thank you, Maria.

[SPEAKER_01]

My name is Maria Ylönen and I'm working as associate professor in risk management at the University of Stavanger.

We will look into four main ideas, statements and issues.

And could you describe them, Terje?

[SPEAKER_02]

Yes, the first one relates to risk perception and expert judgments about risk.

It is based on three ideas or statements.

The first one, A, we call it, risk is the same as risk perception.

B, risk perception covers also professional risk judgments.

And C, risk is a social construction.

And then the second type of statements, risk is more than probabilities and numbers.

And three, resilience needs to be addressed beyond risk.

Resilience needs more focus than risk.

And four, finally, generic risk science knowledge and guidance are not so important.

What matters are the practitioner's experience and understanding of risk.

[SPEAKER_01]

And why these four issues?

[SPEAKER_02]

I would say that that's because these are important topics in risk science and are often discussed among risk and safety scientists, analysts and practitioners, for example, at conferences.

[SPEAKER_01]

It should be mentioned that Professor Aven has several recent publications addressing these topics.

So let us start with the first ideas and statements which relate to risk perception and experts and professional judgments about risk.

And the first part of this statement relates to risk is the same as risk perception.

I have heard people to refer to well-known German sociologist Ulrich Beck and his book on risk society saying something like that.

[SPEAKER_02]

Yes, and I think on page 55 that Ulrich Beck is saying this in this well-known book, because risks are risks in knowledge, perceptions of risk and risk are not different things, but one and the same.

So he is actually saying risk is the same as risk perceptions.

[SPEAKER_01]

And what is your response to this thinking that risk is the same as risk perception?

[SPEAKER_02]

Well, if I'm very direct, I must say it does not make sense.

I mean, there is a fundamental difference between risk as seen from a professional scientific perspective and risk perception.

For sure.

Risk perception can include conscious judgments related to events, consequences, uncertainties, probabilities, the key aspects of risk in a professional context.

But risk perception can also be influenced by feelings, affects, how you like or dislike these events or consequences, uncertainties, which is not the case of a scientific or professional understanding of risk or its characterization.

So, seeing risk as risk perception is in conflict, I would say, with common understanding of what science and risk assessments are.

And this idea or perspective does not have a central place in risk science literature and practice today.

And that is a good thing, in my view, I would say.

So I would argue that as a conclusion that this idea here that risk is the same as risk perception is in conflict with fundamental risk science knowledge.

[SPEAKER_01]

However, risk perception covers also professional risk judgment.

I think you have already touched that issue.

[SPEAKER_02]

Yes, this was the second point, that risk perception covers also professional risk judgments.

And yes, certainly risk perception can include conscious judgments related to events, consequences, uncertainties and probabilities.

That's all the elements of what the professional judgment of risk covers.

It is, I would say, it's a misconception that people's, lay people's risk perception is all about feelings and non-scientific factors.

Risk perception research has shown that there is often a difference between experts' risk judgments and people's risk perception.

But this difference can be explained also by the fact that people's judgments could incorporate aspects of uncertainty

not covered by the experts' risk perspectives.

Experts often restrict their assessment to probabilities, expected values and historical data and do not cover all relevant aspects of risk.

[SPEAKER_01]

That's interesting.

And such an expert perspective on risk is clearly problematic.

[SPEAKER_02]

Yes, I would say that restricting risk to probabilities, expected values and historical data is problematic.

So from a risk science perspective today, I would say that it can of course be discussed what is the most justified approach when it comes to conceptualizing and describing risk.

But to me it's clear that uncertainty should be a main component of risk, and hence people's risk judgments or perceptions could reflect risk better than the expert's judgment in some cases.

I say, I mean, in some cases, because it's clear that without science, with science competence, the risk judgment could be poor or inconsistent with a lot of doubtful factors influencing the judgments in some cases.

But, as I stressed, they could also be very informative as they capture important aspects of risk.

[SPEAKER_01]

So we should take people's risk perceptions seriously?

[SPEAKER_02]

Yes, of course.

They reflect peoples' concerns.

And that is important information.

And as we discussed, the perceptions could also reflect important aspects of risk, not adequately reflected by the experts.

Experts can be wrong.

At the same time, we should take the perception for what they are, perceptions.

And they can, of course, be of variable quality and importance.

[SPEAKER_01]

Risk is a social construction.

This statement one hears often.

How would you comment on that?

Is it correct?

Is it controversial?

[SPEAKER_02]

Yes, this is number C statement.

And I will start by saying that seeing risk as a social construction is not controversial if risk is interpreted as the risk assessment results, the risk characterization results.

The risk measurements, descriptions, characterizations, is not objective.

For example, when saying that the likelihood for this event to occur, leading to severe consequences, for example, loss of lives, is less than, say, 1%.

And the knowledge supporting this likelihood judgment is strong.

This is a judgment made by the risk analyst.

It is subjective or intersubjective.

We agree.

The judgments are to be interpreted in a social and cultural context.

Thus, they can be seen as social constructions, although the derivation is based on some scientific procedures and standards.

And I like to read a paragraph from a paper from Sheila Jasanoff, 1999, page 147, which I think is highly relevant here.

I have suggested that the social sciences have deeply altered our understanding of what risk means, from something real and physical, if hard to measure, and accessible only to experts, to something constructed out of history and experienced by experts and laypeople alike.

Risk in this sense is culturally embedded and has texture and meaning that vary from one social grouping to another.

Trying to assess risk is therefore necessarily a social and political exercise, even when the methods employed are the seemingly technical routines of quantitative risk assessment.

And ending of that quote.

And there are many good points here, I would say.

But there is a need to stress that she focuses on the risk assessment and related measurements and characterizations.

And they are to be seen as social constructions.

Yes, they are influenced by social factors.

[SPEAKER_01]

So risk assessments and related characterizations are social constructions, but that is not the same as saying that risk as a concept is a social construction.

Is this correct?

[SPEAKER_02]

Yes, this is correct.

And there are risk perspectives in risk science where the risk concepts can be viewed as objective or intersubjective.

We all agree.

And this has been discussed extensively by Eugene Rosa, a professor, some 25 years ago.

And he referred to risk as an event.

And if we have that kind of perspective on risk, risk is not to be seen as a social construction at all.

It is objective to some extent.

But when we come to the measurement and characterization of the magnitude of this risk, we perform a risk assessment.

The result is to be seen as a social construction.

The risk characterization is influenced by social factors.

But I will also stress that there are scientific procedures and standards that aim at reducing the influence of such factors.

But of course, they cannot be fully removed, this type of factors.

[SPEAKER_01]

Let us move to the second common statement or idea that risk is adequately understood and characterized using quantification, probabilities and numbers only.

[SPEAKER_02]

Yeah, the need for a broader perspective on risk, seeing beyond the numbers, the risk calculations or probabilities, has been stressed by many scholars over the years.

Remember the quote from Sheila Jasanoff, 1999.

And the critique against the narrow quantitative risk perspective came from social scientists working with risk perception and communication topics.

I could mention Paul Slovic, Baruch Fischhoff, Ortwin Renn and many, many others.

But the critique also came to some extent from within the risk assessment environment in itself.

And this critique was also constructive in the sense that alternatives were suggested and developed.

[SPEAKER_01]

So criticism has been expressed from different scholars from different disciplines.

[SPEAKER_02]

Yes, absolutely.

Absolutely.

[SPEAKER_01]

First, can you say some words about why quantification is so attractive among many?

Is it because quantification is seen as providing some type of objectivity?

[SPEAKER_02]

Yes, quantification can be very useful in many cases.

And I remember when I worked in the industry,

We calculated loss of production volumes and availability, reliability numbers for alternative systems in a production setting.

And from that, we could calculate metrics on costs and incomes that gave very informative decision support on what alternative or option to choose.

But even if the analysis were based on a lot of relevant data and detailed modeling of the systems, the analysis was not seen as prescriptive, saying what to do, but just providing input to that decision-making process.

It was acknowledged that any analysis has limitations.

[SPEAKER_01]

So numbers can be very convincing.

[SPEAKER_02]

Yes, they can.

And if we are presented, for example, numbers for the flying by commercial airlines, it is strong evidence that going by plane is safe.

Typical numbers presented for recent years, I think, are about 0.1 to 0.5 fatalities per million flights for commercial airlines.

Extensive amounts of data are available, and the numbers are very low compared to other activities we typically accept.

I should mention also that there are other issues here.

I mean, people can perceive the risk differently, but that's another issue.

[SPEAKER_01]

So we can conclude that it is safe to fly as the probability of undesirable consequences is low and the supporting knowledge strong.

[SPEAKER_02]

Yes, exactly.

So even in this case where we have a lot of data, there are qualitative elements.

We need to conclude that the data are relevant and that the evidence supporting the probability judgments is strong.

The key message, qualitative judgments always accompany the quantification.

[SPEAKER_01]

Is it always so?

[SPEAKER_02]

It should.

[SPEAKER_01]

But things are more complex when the uncertainties are larger.

[SPEAKER_02]

Yes, for sure.

Then there is an issue to what extent the quantification is useful at all.

When specific numbers and probabilities cannot easily be justified.

Many scholars are skeptical using numbers in such cases, as the numbers are not objective.

They seem arbitrary.

But my response to that is that the numbers can still be useful, at least in some cases, but we need to understand what they mean and are supposed to express.

Say that we consider some events and scenarios, A1, A2, and so forth.

The uncertainties are large.

Should we then express the associated risks?

We should, I would say, to the extent possible, as we need to use our resources in the best possible way, as we cannot use enormous resources on everything.

[SPEAKER_01]

But how can we do that?

[SPEAKER_02]

We assess risk, but risk does not need to be quantified to be informative.

[SPEAKER_01]

Can you give some examples?

[SPEAKER_02]

Yes, but first some principles for how to think.

The key is to address likelihood and knowledge evidence together.

Not only likelihood and not trying to give one specific number, but rather intervals or even qualitative terms.

Here are some examples of statements of that type.

[UNKNOWN_SPEAKER]

1.

[SPEAKER_02]

Scenario A1 is not likely, and there is some evidence supporting that.

And here it is, the evidence.

Not very precise, no numbers, but still better than nothing, isn't it?

Scenario A2 is not likely.

Less than 1% is our judgment.

And the evidence is relatively weak.

And here it is.

For example, pointing to key assumptions which can be questioned.

Example 3.

Scenario A3 is plausible in the sense that there is some evidence, and here it is, indicating that the scenario may happen.

A positive likelihood.

And the fourth example, an interval of about 100 to 10,000 fatalities is predicted with rather high likelihood and moderate strong knowledge support.

And here it is.

[SPEAKER_01]

In all these examples, there are likelihood and knowledge or evidence judgments.

Am I right?

[SPEAKER_02]

Yes, as these are the main elements of any judgment of risk, likelihood and knowledge evidence.

[SPEAKER_01]

And there is also the issue about surprises and the unforeseen.

Could you elaborate on that?

[SPEAKER_02]

Yes, this is a difficult issue.

As knowledge is a judgment, it is about justified beliefs.

And these beliefs could be wrong.

For example, an assumption could turn out to be wrong and a surprise occurs.

[SPEAKER_01]

How should one deal with that type of risk then?

[SPEAKER_02]

It is challenging, of course.

It cannot be quantified.

It is still an important aspect of risk.

If we think about long-term effects of a medical treatment, we may not have any data.

But certainly, the issue needs to be addressed in a risk assessment if that assessment is to cover all aspects of risk.

[SPEAKER_01]

There are different methods and approaches for dealing with this issue, am I correct?

[SPEAKER_02]

Yes, and I would say that just acknowledging the issue is a very, very good start for dealing with that, making the assessment framework, addressing it.

And if the starting point is a quantitative perspective on risk, risk is defined through probabilities, this will not work.

The motivation for some of the broader risk perspectives we see today, where uncertainty is a main component of risk, together with the consequences of the activity considered, is to meet this challenge.

These perspectives acknowledge that there is a gap between risk as a concept and how we are able to measure or describe that risk.

There are limitations in the way we measure and describe risk and potential surprises, and the unforeseen represents a main Challenge/problem.

So by evaluating the assumptions,

making sensitivity analysis, analysis of deviation from the assumptions, and so forth, potential surprises can be identified.

Also, work is done to improve the risk assessment on this point, and that is important.

We especially focus on the threat/hazard identification processes and trying to understand what's going on, what are the underlying factors influencing the risk, the mechanisms influencing the risks.

[SPEAKER_01]

there are also special methods like red teaming, etc., that can help identifying potential surprises.

[SPEAKER_02]

Yes, there are.

But we have to acknowledge that we cannot fully describe and assess this type of risk.

And that is why we focus today on resilience, which is very much about arrangements to be able to deal with potential surprises and the unforeseen.

And I would like to end this second issue by saying that if we focus too much on potential surprises and the unforeseen, we could be too risk-averse and nothing good would happen.

Just stress of always thinking about something bad that potentially could occur in the future.

[SPEAKER_01]

This leads us to the third category of issues.

Resilience needs to be addressed beyond risk.

And resilience needs more focus than risk.

What is your response to these statements?

[SPEAKER_02]

Let me first say that traditional risk management frameworks based on risk assessments do not necessarily address resilience at all.

For example, the ISO standard 31000 on risk management does not address resilience.

But I would say that

Today, modern risk management and governance frameworks highlight resilience very much to meet complexity, uncertainties, surprises and the unforeseen.

[SPEAKER_01]

And what is your response to these statements?

Resilience needs to be addressed beyond risk and resilience needs more focus than risk.

[SPEAKER_02]

Well, the answer depends on how you understand these concepts.

There's a discussion about these issues.

But I would say that from a risk science perspective, a contemporary risk science perspective, I would respond like this.

Resilience management is a core strategy of risk management and governance.

We cannot think risk management and governance without building resilience, being able to quickly return to the previous state or similar, maintaining, regaining functions given a disturbance.

This is an issue addressed for basically all type of systems.

And I cannot see that resilience extends beyond risk considerations using today's thinking about risk.

So for me, the statements that you refer to, resilience needs to be addressed beyond risk and resilience needs more focus on risk, have no meaning as improving resilience is about managing risk.

[SPEAKER_01]

Nevertheless, resilience management or engineering has been developed with different and alternative concepts and principles and methods.

Is there a conflict between risk science concepts and methods and resilience management concepts and methods?

[SPEAKER_02]

Well, yes, resilience has been a new type of school of thought, somewhat in parallel to the risk world.

And this is, in my view, unfortunate as what we need is integrated perspectives highlighting both risk and resilience in line with what I refer to as contemporary risk science.

Resilience should be focused as it is important, but it should not be seen as separated from the risk world.

[SPEAKER_01]

It is often highlighted that resilience management is not depending on risk considerations and assessments to be effective.

Is this true?

[SPEAKER_02]

Yeah, I mean, for example, having redundancy in a system may be an effective resilience management strategy, and it does not require assessing specific events and risk to be implemented.

There is, however, a need for ways to describe and compare the resilience for alternative arrangements and measures.

Resource limitations mean that we have to prioritize.

Where should we improve the resilience?

then we need to address risk in some way, not by quantifying risk, but by assessing risk, as discussed earlier, crude likelihood judgments, knowledge strength judgments, identifying critical assumptions, plausibility judgments, and so forth.

[SPEAKER_01]

Erik Hollnagel has made important contributions to the resilience field, and I have noticed that there has been some interesting discussions between him and Nancy Leveson recently.

[SPEAKER_02]

Yes, very much.

And Hollnagel has this focus on what can go right.

He's saying it's more important or should be more important that things go right than that things do not go wrong.

And for Hollnagel, an important aspect of resilience is that this focus on things going right.

And Leveson questions the rationale for this reasoning.

She asks, is it more important that passengers

enjoy their flight, a thing that can go right, than that planes do not crash, a thing that can go wrong.

She warns that too strong a weight on what goes right could lead to a dangerous practice, as resources are used on aspects that are not important for preventing hazards and accidents or reducing their consequences.

[SPEAKER_01]

And what is your view on this?

[SPEAKER_02]

Well, focusing on what can go right also has a value.

But I follow Leveson here, and I agree with her argumentation.

We need to have a focus on what can go wrong.

And this discussion also relates to the question about what safety means.

Some resilience scholars indicate that safety should be defined as the ability to succeed in varying conditions.

And I say the safety concept cannot solely be linked to success.

It needs to relate also to undesirable events and consequences; without specifying what no success means

it's impossible to make meaningful judgment about safety being large or small.

And the second point, the safety concept cannot be defined purely based on absence of freedom from undesirable events or consequences either.

The severity of these undesirable events/consequences also need to be reflected.

And the third point I'd like to add here, the safety concept cannot be defined without addressing uncertainty -
thus also risk.

[SPEAKER_01]

Let's move on then to the fourth and last issue.

Generic risk science knowledge and guidance are not so important.

And what matters are the practitioners' experience and understanding of risk.

This issue is about the so-called pragmatic risk perspective, I understand.

And it seems to reject the idea that there exists some best risk science knowledge that we should develop and promote.

You argue that this perspective is in fact anti-scientific in a recent risk analysis paper.

I'm looking forward to your explanations on this.

[SPEAKER_02]

Thank you.

And I would say that over the years, I have met several risk and safety researchers.

mainly from the social sciences who have questioned the need for and importance of risk science work that aims to develop generic guidance on how to conceptualize and describe risk across applications.

These researchers have highlighted the practitioner's need for tailor-made risk definitions and perspectives adapted to the situation considered and based on the practitioner's insights and experience.

The risk science knowledge is viewed as theoretical with marginal relevance and importance to the practitioners.

And I refer to this type of reasoning as a pragmatic risk perspective.

[SPEAKER_01]

Why do you think this perspective is anti-scientific and in conflict with the core ideas of risk science?

[SPEAKER_02]

Well, adapting the risk attestations to the situations considered is not controversial.

But rejecting the idea that there exists some best risk science knowledge that we should develop and promote is highly problematic.

And I'd like to give an example related to the common practice of seeing risk as an expected value.

For short, probability times consequences, P times C. The issues related to this way of understanding risk are well known from the risk science literature, for example, work by Pate-Cornell, Jacob Haines and others.

Nevertheless, practitioners commonly refer to and apply this perspective.

Unfortunately, many practitioners struggle to see what the problematic issues are.

[SPEAKER_01]

Can you give an example about this?

[SPEAKER_02]

Yeah, here is - I'm going to give a quote from a risk manager in the oil and gas industry in Norway, when asked to provide feedback on the CU definition of risk, where U is uncertainty and C is the consequences of the activity.

And this definition has been implemented in the oil and gas industry.

And this is from a paper from Haavik et al.

in Journal of Risk Research, 2023.

And I ask you to read that, Marja.

[SPEAKER_01]

Yes.

So here comes the quotation.

When you look at the consequences of the activity with associated uncertainty, well, that is exactly what we are working with.

The consequences of the activities, potential for leakage, the potential for someone getting stuck in our equipment, the potential for destroying our tools that we must spend time and resources to replace.

So, uncertainty is not a foreign term, but if you choose to use those definitions or not, is to me, well, not very important.

Because we are working with this anyway, to me it's just another way of describing the same.

Yes, it's a product of probability and consequence, but it is also, of course, risk is the consequence of our activity.

That is completely obvious.

[SPEAKER_02]

Thank you.

And if I could just repeat the last two lines there.

Yes, it is a product of probability and consequence, but it's also, of course, risk is the consequence of our activity.

That is completely obvious.

So I would say from a risk science perspective, this quote suggests that the manager may not fully grasp

what the difference between these perspectives $P \times C$ and CU is all about.

The manager does not see any difference and refers actually to C and not CU .

in the last sentence of the quote and saying that that's the same as $P \times C$. So CU is the consequence and the U is the uncertainties and

P is the probability and C is the consequences. So we have the expected value.

So the manager does not see the difference between saying that risk is expected value -

probability times consequences, or risk is a combination of consequences and uncertainties.

And this is fundamental different concepts and ideas.

And of course, as an empirical observation, it's interesting that the risk management does in fact have this understanding, but is not, and I ask, is not the main conclusion that the practitioner

has missed an important point and needs to upgrade his or her knowledge?

To me, that's the case.

I would argue that a main message here is that generic guidance is needed to help practitioners, like this risk manager, improve his or her risk understanding.

And I question, does a pragmatic risk perspective suggest that such a guidance is not needed?

[SPEAKER_01]

You mentioned to me about a review of a paper you have written discussing this.

[SPEAKER_02]

Yes, this reviewer indicated that the practitioner was not necessarily wrong.

I would argue the manager is wrong, has not understood the difference between the two risk perspectives.

But of course, the manager can still having a useful approach to risk and risk assessment in the practical situation considered.

But the manager has not understood an important point in risk science, and that could easily lead to

poor judgments about risk, for example, not giving sufficient attention to aspects of risk beyond expected values.

[SPEAKER_01]

Probability is a challenging concept and certainly guidance is needed to adequately understand and apply this concept.

What do you think?

[SPEAKER_02]

Yes, there's a lot of confusion about probabilities and it is not only of a theoretical interest.

It has to do about how to conduct the risk assessment and communicate the results.

Let me give an example, going back to the well-known Kaplan-Garrick paper in Risk Analysis Journal in 1981, expressing that risk is quantitatively expressed by the triplet event/scenarios, consequences, and probabilities.

Here the probabilities are either of a frequentist type or subjective.

In the former case, there is a need for uncertainty assessment of what the true underlying correct frequentist probabilities are.

That's not the case if subjective probabilities are used.

[SPEAKER_01]

Yes, because there are no true or correct subjective probabilities, right?

[SPEAKER_02]

Yes, many scholars have discussed that issue.

But from a practical point of view, the scientific message was confusing.

When I worked in the industry in the 90s, I struggled to use such probabilities as there were a lack of clarity on the basic ideas and relevant guidance, I will argue.

Guidance was strongly needed at all levels of applications.

Today, we have that kind of guidance, but still, practitioners struggle to explain what a subjective probability means and use them in a meaningful way in practice.

[SPEAKER_01]

Can the risk science knowledge be tailor-made to specific situations?

[SPEAKER_02]

Well, risk science provides knowledge relevant for all areas or at least some types of areas like health, business, climate change.

But this does not mean that the knowledge cannot be tailor-made to specific situations.

It may, for example, specify conditions when a specific risk metric, for example, expected values, is appropriate and when it is not.

[SPEAKER_01]

Risk science is about learning across applications, right?

[SPEAKER_02]

Yes, yes, yes it is.

Science is about the best knowledge, the most justified knowledge, and this is built on all levels of input, as well as practical knowledge gained at the operation levels.

If practitioners are happy with considering risk as an expected loss,

Practical knowledge and a pragmatic perspective will not challenge that approach.

And that can have potential serious consequences for the understanding, communication and management of the risks.

[SPEAKER_01]

And who is responsible for developing the guidance?

[SPEAKER_02]

Well, that depends on the level, I would say.

At the generic level, it is knowledge societies like Society for Risk Analysis, ISO, but also individual researchers writing textbooks and so forth.

Then we have industry level with industry standards and guidance, operational procedures and so forth.

[SPEAKER_01]

I think translation from generic to practice is also important.

[SPEAKER_02]

Yes, very, very much.

And I agree.

And that should be an important task at all levels from the generic to industry, sub-industry, organization and so forth.

[SPEAKER_01]

Thank you, Terje, for these interesting and important clarifications.

I hope these ideas about risk motivate the audience to reflect on the foundations of risk science.

Thank you very much.

[SPEAKER_02]

Thank you.