The future isn't what it used to be!

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Abstract

The uncertainties inherent in EIA predictions frequently are not made patent, whether consciously or unconsciously. Real impacts may be greater or less than predicted, or unanticipated impacts may occur due to the manifestation of environmental risk, such as those derived from the effects of climate change. Risk and uncertainty are difficult concepts for regulators and other parties, but nowadays almost everybody has some knowledge about climate change, in many cases because people have suffered the impacts of extreme weather. So EIA practitioners could benefit from this situation as a paradigm for explaining to the various parties the uncertainties associated with impact assessment.

The ISO 31000 standard provides a useful definition of risk as "the effect of uncertainty on objectives". Therefore risk may be defined in terms of the objectives or expectations of a given party in a given enterprise. This should lead the EIA practitioner to analyze the risks of an enterprise and consider the risk communication from the point of view of each party. The authors will present a theoretical proposal on how risk and uncertainties could be expressed and communicated based on the climate change paradigm.

Decisions in view of EIA risk and uncertainty

The IAIA14 conference sets out its theme as follows: Can social and economic development be mutually compatible? Social development should be understood not only as a result (income growth and poverty reduction) but also as a process of change that leads to equality, social and environmental justice, cultural recognition, and democratization of politics. *For this, increase in public participation in decision-making is a fundamental component of social development.*

The last sentence focuses attention on uncertainty and risk present in IA, since public participation in EIA decision-making requires a communication of IA uncertainties to the public. Once we accept that an IA process includes uncertainty in the forecasting of impacts, we find that the various parties involved are confronted with risk. This paper presents an overview of the concepts of uncertainty and risk in IA, using climate change risk as a paradigm for the understanding of environmental risk.

Risk and uncertainties in climate change assessment

Risk is a proposition about future events; uncertainty is a state of current knowledge. According to Painter (2013), the word uncertainty is frequently interpreted by the lay public to imply complete, rather than relative, lack of knowledge – or in other words, ignorance. Words such as "may" or "might" used to signify uncertainty can often be interpreted by lay people to mean that scientists are ignorant rather than uncertain. Some academics argue that climate change has to be re-framed away from the technical uncertainties in the science and more towards the risks to society, and this change of emphasis can enhance engagement and understanding.

Politicians, scientists, and policy makers are increasingly using the concept and language of risk to frame what is probably the greatest challenge of this century, human-induced climate change. There is an understanding that placing more emphasis on the climate change challenge as risk may be a helpful tool in framing or communicating uncertainties around it. They argue that such a

framing can give policy makers more clarity about options and the process of making decisions about these options. One example of this portrays the climate change problem as one of risk that the continuing rise in greenhouse gas emissions from human activities may well exacerbate weather extremes that cause widespread and harmful impacts.

Acceptance of climate change

After much debate, people have accepted the reality of climate change, even though there may be discussion about the relative importance of causes, and about the velocity of the impacts. In general this is not a discussion about levels of education or sophistication, but about people's perspective on life. Climate change is a very subtle effect expressed in terms of a few degrees of average temperature and slight changes in other climate parameters. However, what seemed very remote, gradual and even uncertain became widely accepted. Acceptance of climate change emerged for the following reasons (Steward, 2013):

- There was a gradual convergence of scientific opinion.
- The scientific opinions from credible (academic) institutions were published in widely available media.
- Opponents of the academic consensus were characterized as representing industries that had an interest in denying climate change.
- Politicians (e.g. Al Gore) started to talk about climate change.
- The changes were sensed by many as aligning with their own experience of warming trends.
- Warming trends were confirmed by melting of the Arctic ice shelves.

Understanding of climate change risk

People come to terms with risk on different time frames: immediate risk of safety (road accident), medium term risk of illness (cancer) and long term risk of environmental deterioration. This is also described as risk velocity, which refers to the timeframe in which the event turns into an impact. A road accident immediately develops into an injury; the occurrence of a cancerous growth gradually develops into a chronic disease; an environmental emission may take a long time to give rise to a deterioration in an ecosystem. It can be inferred that the longer the risk term, the harder it is for people to understand the risk and be influenced in their decision making. The effect of climate change provides us with an example of people coming to terms with environmental risk, and provides a paradigm of how people can assimilate environmental risk in the longer time frame.

The understanding of climate change risk emerged from the following (Steward, 2013):

- It was explained that climate change would produce visible impacts such as extreme weather, and this was experienced and seen by many. This was something that hurt people.
- It was explained that climate change would produce regional changes, that its effect would be uneven around the globe. Therefore, some would be more affected than others.

- Climate change *scenarios* were converted into semi-quantified impacts that people could related to, such as reduced rainfall, loss of arable land, increased building cost, cost impacts to business and increased costs for health care.
- It became understood that these things would start to impact in our lifetimes. For example, according to the National Resources Defense Council[1], the insurance industry estimates that 2012 was the second costliest year in U.S. history for climate-related disasters, with more than $139 billion in damages.

Understanding the estimation of risk

It has become evident to many people, including key decision makers in government and corporate worlds that risk is composed of the probability of occurrence of an event and the severity of the impact, which is in turn a function of vulnerability and exposure (following terms and definitions of ISO 31000 Risk Management Principles and Guidelines). Accordingly, the Impact Associated Cost (IAC) may be expressed as:

(IAC) = (p/CC) (K)

Where

p/CC = Probability of occurrence of the impact, given diverse pre-existing conditions (CC)[2]

K = Severity of the impact, translated into the cost of the measures required to repair the damage produced by the impact, and to reduce to a minimum the damage from a similar event in the future.

The probability of occurrence of extreme climatic events is widely understood to have increased in recent years. Also, the vulnerability factor has increased, as an increased number of people have settled and industrial sites have been established in areas exposed to natural hazards (coastal areas, low-lying islands, city margins and so on). Therefore the impact associated cost is rising sharply.

Risk and uncertainties in EIA

It has been suggested that the EIA is ideally the procedure where uncertainty factors and possible environmental risks should receive constant attention (Lawrence, 2003). One of the relevant parts of the evaluation of environmental impact consists of the development of an environmental scenario, in which the impacts of inserting a project in a given study area are visualized. The construction of the scenario is carried out in the framework of uncertainty with respect to the magnitude, location, extension, duration, synergy and accumulation of the impacts. The analyst has to assess a certain estimated value for each criterion and for each impact (Bojórquez-Tapia et

[1] http://www.nrdc.org/globalwarming/taxpayer-climate-costs.asp

[2] The term CC refers to the various conditioning factors which result in the impact. The p/CC is therefore a conditional probability in the Bayesian sense. One of the most conspicuous factor is time: a longer period of analysis or project life increases the likelihood that the impact occurs, regardless of all other factors (economic, environmental, social, political) that may contribute to the occurrence of the impact.

al, 1998). In this scheme the probability of occurrence should also be represented, in order to capture the uncertainties in the representation of the scenario.

However, for various reasons EIA's do not normally reveal their uncertainties and their analyses seem almost deterministic. We emphasize "almost", because EIA's normally incorporate a monitoring program to detect impacts and contingencies, and analyze whether the expected environmental and social impacts occur during the life of the operation within the predicted parameters.

It is understandable that uncertainty is not made patent, because on the one hand EIA practitioners try to satisfy the project proponents' desire for certainty in the outcomes of their projects (the mind-set of the industrial world assumes that there is a key to prediction and control) and on the other hand, neither party wants to see the EIA process exposed to controversy and the possibility of litigation.

In contrast with EIA practice, climate change scientists have made patent their uncertainties about the magnitude, location, extension, duration, synergy and accumulation of the effects ever since the phenomenon was subjected to study.

Communicating EIA risk and uncertainty

Once we accept that an IA process includes uncertainty in the forecasting of impacts, we find that the various parties involved are confronted with risk. Now risk has an objective component and a subjective component (Hopkin, 2010; Kahneman & Tversky, 1979; Slovic, 2000). The objective component refers to the scientific estimation of the unknown, whereas the subjective component refers to the personal appreciation of the unknown. The logic linking the objective and subjective components is as shown in fig. 1.

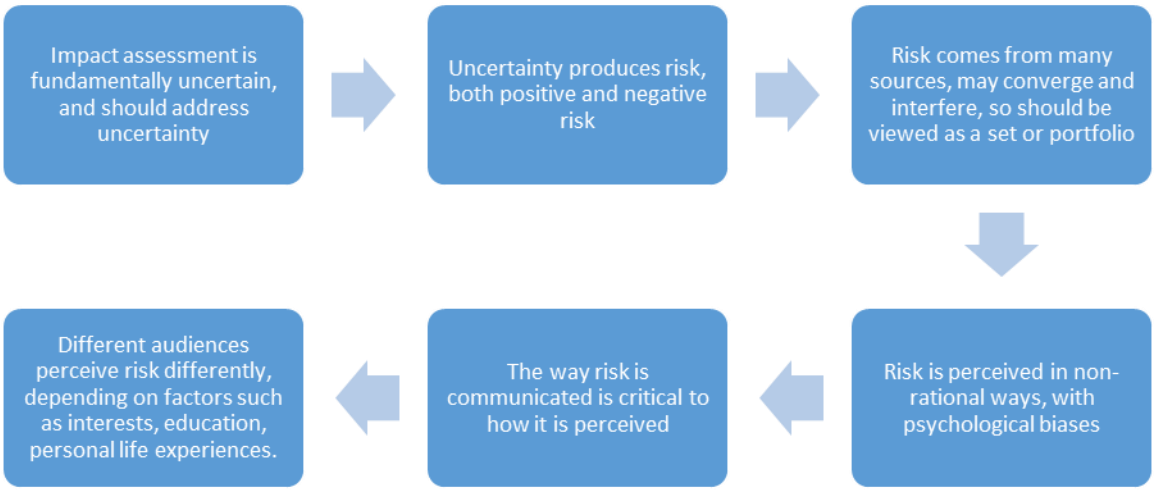

Fig. 1 Perception of Risk

To deal with both these components of risk, the IA practitioner, the project proponent (for this article we will consider this as a representative of private industry) and the IA regulator-evaluator will need risk assessment and risk communication tools (Dickson, 2013). To start talking about risk we need a common vocabulary. The ISO 31000 risk management guidelines present a definition of risk as "the effect of uncertainty on objectives or expectations". This implies that a given risk looks different depending on the person's objectives or expectations. Let us consider a typical IA process. The stakeholders in our IA process can be grouped under: the public, the government regulator and the industrial proponent. How will these groups view the risks involved in the process? What will their objectives and expectations be?

- The public may be looking for protection of their immediate environment and their wellbeing.
- The government may be looking for alignment of the proposed project with the existing public programs and development plans.
- The industrial proponent will be looking for the fastest and most favorable approval in accordance with its project design and corporate standards.

Therefore, the IA practitioner should first understand the objectives and expectations of each of the parties involved in the decision-making process, and should frame the uncertainties and risks in the assessment in terms of these objectives, and not only in terms of the proponent's objectives, or the proponents perception of the stakeholders' objectives (Kytle & Ruggie, 2005; Woods, 2008).

In terms of climate change risk, each of the parties came to understand how it could affect them in their lifetimes (Steward, 2013, Adams & Thomson, 2002). They abandoned fallacies like: "government will have to find a solution" or "technological developments will overcome this", and started to see that adaptation to the impacts was a necessary part of the response strategy.

In terms of other environmental risks in an EIA, people in the different stakeholder groups can respond constructively if:

- There is a scientific consensus and a clear explanation of the effect.
- There is an acceptance of uncertainty and ranges of outcomes.
- The effect is explained in terms of how this could affect each party.
- There is a path of adaptation available to each party. It is not simply an impact that must be accepted with the enterprise, but there is a response level in the event of a manifestation of the impact.

Recommendations for assessing and communicating risk in EIA

Given the above considerations, the following guidelines are proposed for communicating risk in impact assessment:

1. Recognize where uncertainty exists in the environmental assessment, and do not pretend that it does not exist.

2. Adopt the rules of risk assessment when confronted with uncertainty in impact assessment. Considers ranges or scenarios and their likelihoods and severity of consequences.
3. Understand the objectives and expectations of each of the parties involved in the decision-making process, and frame the uncertainties and risks in the assessment in terms of these objectives.
4. Express the uncertainty and the assessment in general in language that the stakeholder group can understand and in terms that they can relate to.
5. With the risk or potential impact, provide adaptation or response options.
6. Allow feedback into the IA process in pursuit of a common understanding and a negotiated agreement of impacts on objectives.

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