25 Why did business not react with precaution to early warnings?

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In the past, companies have frequently neglected early warning signals about potential hazards for human health or the environment associated with their products or operations. This chapter reviews and analyses relevant interdisciplinary literature and prominent case studies — in particular those documented in both volumes of *Late lessons from early warnings* — and identifies main factors responsible for the disregard of early warning signals.

The chapter shows how economic motives often drive non-precautionary business decisions. In virtually all reviewed cases it was perceived to be profitable for industries to continue using potentially harmful products or operations. However, decisions are also influenced by a complex mix of epistemological, regulatory, cultural and psychological aspects. For instance, characteristics of the research environment and the regulatory context can provide business actors with opportunities to enter into 'political actions' to deny or even suppress early warning signals. Also, business decision-makers face psychological barriers to awareness and acceptance of the conflicts of values and interests entailed by early warning signals. Cultural business context may further contribute to the denial of conflicts of values.

The chapter concludes with a set of reflections on how to support more precautionary business decision making. A prominent policy response to the conflicting interests of business and society is introducing regulations that attempt to steer business rationality towards internalising external effects. Innovative solutions such as assurance bonding should be considered.

There is a need to better understand and expose why business actors do not respond voluntarily to early warning signals with precautionary actions. Blaming business, in particular with hindsight, tends to be common reaction that may not always be constructive. It often misses the complex or even contradictory set of motives and drivers that business actors face.

Public institutions could support progressive business by analysing and publically disclosing the dilemmas and temptations entailed by early warning signals, for example for different industries and for the specific societal and regulatory context of decisions. Rigorous and explicit exposition of the dilemmas will create further incentives for responsible actors to share and communicate their precautionary responses.

An additional reflection centres on the role of political actions of business actors, in particular those actions aimed at suppressing early warning signals. Regulatory efforts that make the political actions of business more transparent can help to sustain a sound balance of power, thereby maintaining our ability to benefit from early warning signals and reducing the likelihood of health and environmental hazards.

25.1 Introduction

Late lessons from early warnings (EEA, 2001) describes a number of prominent cases in which early warning signals about potential hazards from the use of commercial products or operations have been neglected over long periods of time, eventually with grave consequences for human health and the environment. While the volume derives lessons which focus primarily on improving decision-making by regulatory agencies, it becomes also very clear that decisions to act with precaution — or the failure to do so — often involved business actors. Private companies have been the main drivers of innovative activity and, notwithstanding the benefits they have generated for society, their business practices and products have in many instances also caused considerable harm. In essence, EEA (2001) shows that business decisions played a major role when things went wrong.

So why did companies not act with precaution when early warning signals were available? In this paper, we review case studies from EEA (2001) as well as some additional 'early warnings' cases which appear in this volume. We look for patterns in these past experiences and study relevant interdisciplinary academic literature with the aim to analyse and better understand the situation of companies that are confronted with early warnings. We identify several potential impediments for business decision-makers to act in a precautionary manner, which we summarise in three 'lessons about business'. We conclude with some reflections on how to support more precautionary business decision-making in the face of early warning.

There is no doubt that many business actors recognise their responsibility to strive for economic benefits, in line with a wider regard for human welfare and with respect for the natural environment (see WBCSD, 2010). This analysis should be useful for decision-makers to be aware and better understand the challenges and potential pitfalls of business behaviours when dealing with early warnings. For policy makers as well as the general public, the analysis should foster a more integrative and differentiated judgement of the role of (different) types of business actions towards society.

25.2 Impediments for companies to respond to early warnings in a precautionary manner

25.2.1 Economic rationality

The standard economic paradigm that underlies typical present day business decisions takes root in the times of classical industrial society (Shrivastava, 1995). Private corporations in a market economy are regarded as systems of production with the purpose of profit maximisation. In such a worldview, economic value created by business actors is understood primarily as financial returns to owners, typically the shareholders. Though a variety of novel approaches have been brought forward (e.g. Kelly, 2001, 2012), this paradigm is the main driver behind management decisions. It is embedded in decision tools across corporate units, and remains the core element of management education. Since half a century, it has been to a large extent shared and supported by mainstream ideology and the public perception of the role of business within a free market society (Friedman, 1970; Karnani, 2010).

The idea of profit maximising firms embraces a rationality according to which ethical values are reasons to act if and only if they contribute to the expected economic benefits for the business actor (Le Menestrel, 2002). In particular, nature and society at large are external to the business environment, and potential societal and environmental costs are not to be taken into account in business decisions unless they imply potential costs for the business actor. Accordingly, the internal risk evaluation that is part of the standard cost-benefit analysis toolbox is typically limited to minimising financial business risk, i.e. the comparison of expected revenue or profit figures (Sommerfeld, 2010). External risks to human health or the environment may enter the calculations, but only insofar as they indirectly pose a business risk via legal liabilities, regulatory restrictions or reputation risks for the company.

Economic rationality is thus remote from a proactive precautionary response to early warning signals. Virtually all reviewed cases have in common that early warnings about harmful effects were available, but that the prospect of short-term profit generated strong economic incentives for companies to continue with their practices. The most efficient fishing methods (EEA, 2001, Ch. 2), the sales and use of cheap and effective substances such as benzene (EEA, 2001, Ch. 4), lead in petrol (Chapter 3), asbestos (EEA, 2001, Ch. 5), insecticides (Maxim and van der Sluijs, 2007 and Chapter 16), or growth hormones for meat production (EEA, 2001, Ch. 14) are only some of many examples. Moreover, competitive market forces can further increase the economic pressure for using potentially hazardous product or for gaining a monopoly position from early introduction of innovative products or methods (Gollier and Treich, 2003; Maxim and van der

Sluijs, 2007). Voluntary preventive measures and costly scientific research that may confirm the harm or the involved risks are usually expected to be detrimental to financial performance.

Reputation
Public concerns or 'conscious consumer' preferences for safe products and operations have the potential to induce economic incentives for socially or environmentally responsible business behaviour (Banerjee et al, 2003; Rode et al., 2008). A company that is economically rational will not sell a product that, for reasons of public concern or lack of consumer trust, may not be profitable or give rise to consumer boycotts. The eventual termination of the use of antimicrobials (EEA, 2001, Ch. 9) and of growth hormones (EEA, 2001, Ch. 14) for meat production in Europe was driven to some extent by growing public concern about potential health risks. Such public concern can be a powerful force, no matter whether it is driven by the available scientific evidence or, in some cases, unrelated to evidence, or even overrating the dangers (Sunstein, 2003). In many cases, however, the public lacks knowledge about early warnings, underrates the risks (see also Section 25.2.4 on psychological factors), or does not feel affected. Under these circumstances, public concern about specific uncertain hazards of a particular product or industry is generally absent or weak. Consequently, reputation does not provide a sufficient economic incentive for precautionary behaviour.

Moreover, economically rational companies can decide to influence public opinion in their favour when this appears cheaper than reducing or terminating the potentially harmful practice. If companies themselves hold information about potential harm of their products or operations, they can choose not to disclose it. Voluntarily disclosing early warning signals about a potential hazard creates the risk that consumers refrain from buying the product, and consumers seem to reward transparency and honest disclosure of negative information only under very limited conditions (Aktar and Le Menestrel, 2010). When negative information is generated outside the company and becomes public, we describe below that companies have in the past employed a variety of measures to influence public opinion in order to prevent or at least weaken reputation risks.

Economic interest in preventing harm
In some instances, specific industries stand to lose from potential hazards and have an economic interest in precautionary termination of the potentially harmful activities. For example, when inshore cod fishers in Newfoundland suffered from falling catches due to unsustainable off-shore fishing practices (EEA, 2001, Ch. 2), they reacted with protests and the commissioning of a report, which gained media attention and eventually lead to an official reappraisal of the situation on depleted fish stocks. The Arcachon oyster industry feared the harmful effects of TBT as antifouling biocides for boats and strongly supported the implementation of restrictions on the use of TBT (EEA, 2001, Ch. 13). Beekeepers suspected early on a toxic effect of the insecticide Gaucho on bee populations and fought hard for the recognition of the evidence (Maxim and van der Sluijs, 2007 and Chapter 16). These cases, however, seem to be a minority compared to those where industries have direct and strong economic motives against taking precautionary measures.

25.2.2 Uncertainty in science and the research environment

Scientific uncertainty
The research community is expected to provide the necessary scientific evidence for determining whether early warnings of hazards are credible and substantial enough to justify precautionary measures. However, the prevalence of scientific uncertainty about hazards can weaken acceptance of such evidence and act as an impediment to precautionary responses to early warning signals. Here it is important to consider, however, that the uncertainties that companies face today are increasingly characterised by indeterminacy and even ignorance (Stirling, 2003). Typical examples are the effects of industrial operations and substances on (marine) ecosystems (EEA, 2001, Ch. 2) and the uncertainties regarding environmental or health effects of mobile phones (Chapter 20), GMOs (Chapter 18) or nano-technologies (Chapter 21). It seems difficult for people to cognitively deal with and to act upon such strong uncertainty (Weber, 2006 — see also Section 25.2.4 on psychological aspects below) and to comprehend the complexity of natural systems (Sivakumar, 2008; Kysar, 2009). Moreover, it becomes problematic to apply the standard risk analysis tools that are based on cost-benefit analysis and require knowledge of the set of possible outcomes and estimated probabilities of their occurrence, which are not always available (Ashford, 2005). It remains a challenge for social science, and in particular for business research, to develop appropriate concepts and operational tools that help companies deal with this type of uncertainty (e.g. Kunsch et al., 2009).

Secondly, it is often not recognised — and not communicated sufficiently to the general public — that even when scientific evidence with probabilistic data exists, uncertainty is an intrinsic and essential characteristic of science. There is no scientific justification of a 'sufficient level of confidence' or for the appropriateness of a confidence interval of 99 % or 95 % (Crawford-Brown et al., 2004; Ashford, 2005), and it is an ethical or political issue rather than a scientific one to determine an 'acceptable level of risk' for a 'reasonable fraction of the population' (Crawford-Brown et al., 2004). Moreover, in light of different scientific methods (e.g. based on direct evidence, correlations, model predictions), levels of data quality (e.g. with respect to statistical properties, reliability, relevance or level of scrutiny), and different lines of evidential reasoning (e.g. with respect to conceptual clarity, logical deduction, methodological rigor) the 'weight of evidence' from scientific results is almost always open to subjective judgment and interpretation (Crawford-Brown et al., 2004; Rauschmayer et al., 2009).

Interpreting and 'manufacturing' uncertainty

The uncertain and sometimes ambiguous nature of scientific evidence seems to stand in a stark contrast to the perceptions and idealistic expectations of science by the general public (Ravetz, 2005; van den Hove, 2007) and to its preference for complete certainty for justifying actions, in particular when the actions involve concrete costs (Dana, 2003). This allows industry lobbyists to oppose or prolong precautionary measures by 'manufacturing uncertainty' and generating doubt on the state of scientific evidence. Examples abound where corporate public relations efforts have exploited the subjectivity in judgment and interpretation of particular results, and used rhetorical tricks to emphasise the remaining uncertainty and the need for further research. Rampton and Stauber (2001) give an early account of such processes, while Oreskes and Conway (2010) provide a historical perspective of this controversial interface between science and business. One may also look at Sismondo (2008) for an example in the pharmaceutical industry.

According to Maxim and van der Sluijs, (2007 and Chapter 16), Bayer seems to have repeatedly used selective knowledge and 'semantic slips' to blur the evidence of a toxic effect of Gaucho on bee populations. In the case of benzene, manufacturers hired consultants to downplay the importance of scientific evidence and to introduce irresolvable arguments about dose-response analysis, which delayed governmental regulation (EEA, 2001, Ch. 4). Monsanto in the 1960s launched a public defense of PCBs, arguing that scientific evidence was not clear, and that it would take extensive research, on a worldwide basis, to confirm or deny the initial scientific conclusions (EEA, 2001, Ch. 6; Francis, 1998). Shell in 1967 circumstantiated its denial of a causal relationship between leaking chemicals and effects on wildlife and human health in the Great Lakes area by publishing a report saying that fish killed due to chemical contamination had not been verified by recent studies (EEA, 2001, Ch. 12).

Brush Wellmann in the 1980s hired PR specialists to create a more favourable public opinion and to reassure customers of the safety of beryllium, for instance by claiming that any reports of disease at less exposure than the current limit were scientifically unsound. In the late 1990s, when it was beyond doubt that the established beryllium exposure limit was not effective in protecting workers, Brush Wellmann initiated more research and convened a conference that propagated the need for further research before any new limit could be set (see the analysis at the end of Chapter 6). The millions of pages of previously secret internal tobacco industry documents, made public in the Minnesota trial, revealed the extent to which the effects of nicotine were known and intentionally blurred for consumers by creating doubt about the health risk (Hurt and Robertson, 1998). Similarly, in order to 'keep the debate alive', the tobacco industry financed the creation of new research institutions to carry out research on the effects of second hand smoking (Hong and Bero, 2002 and Chapter 7).

In the early days of the debate about climate change, Exxon was publicly contesting the science, based on its complexity and associated uncertainties. While presenting itself as 'a science and technology-based company', its strategy of preventing political action on climate change was chiefly implemented through efforts in publicly denying the existence of the problem that they had privately identified (van den Hove et al., 2002). In essence, by emphasising the lack of scientific certainty companies can contribute effectively to a 'paralysis by analysis' that prevents precautionary measures in response to early warning signals (EEA, 2001).

Corporate influence on scientific research

When industry and research are interacting closely, for instance in medicine (Sismondo, 2008), companies can also directly influence scientific results. They do not even have to manipulate results or engage in other forms of misconduct, which may happen in some cases (Francis, 1998), but they can effectively bias research results in their own interest by inducing so-called (pro-industry) design

and publication biases. It is common that the main indicator of scientific confidence of a harmful effect is the number of published studies that provide evidence for the effect vs. the number of studies that do not find one. This overall impression of sheer number of scientific results, however, can easily be altered through the selection of which scientific studies to actually carry out (Lexchin and O'Donovan, 2010). In particular since companies typically have significant financial means, they can strive to misrepresent the weight of results in their favour by sponsoring those scientific studies and methods which can be expected to produce favourable results.

As prominently done by the tobacco industry (Grüning et al., 2006), companies can further enhance this bias by organising symposia and publishing their proceedings. Symposia proceedings are typically not peer-reviewed, but still cited as published results. Another example where these strategies were applied is research on the health effects of lead in petrol. As reported in Chapter 3, the relevant studies were conducted and funded exclusively by the Ethyl Corporation and General Motors for over 40 years, and General Motors controlled the publication of results and imposed tight reporting constraints on the regulating US Bureau of Mines. In this case, it is even said that critical independent scientists had their funding withdrawn and their jobs and lives threatened. In the Gaucho debate in the 1990s, Bayer relied almost exclusively on their own research to argue against evidence of toxicity (Maxim and van der Sluijs, 2007 and Chapter 16). In the case of beryllium (Chapter 6), Brush Wellmann financed new publications within the beryllium health and safety literature under the names of well-known academics.

Unfortunately, these cases weaken the credibility of privately sponsored research and create a difficulty for companies that have a genuine and honest interest in objective and unbiased research about the risks of their products or operations.

25.2.3 *Gaps and loopholes in the regulatory framework*

A perfectly operating regulatory system would employ appropriate mechanisms to assure that companies only take the risks that are deemed acceptable by society at large. Commonly used regulatory mechanisms are legal constraints that limit or prohibit certain activities, laws that prescribe safety standards, or liability and tax systems that align the economic interests of the company with the interests of society (Pigou, 1912). The Precautionary Principle is widely recognised as guidance to 'err on the side of caution' and to opt for preventive regulatory measures when an activity is believed to threaten human health or the environment, even if there is no scientifically established evidence (Tickner and Raffensberger, 1998). Within a perfect regulatory system, it may be argued that the sole responsibility of a company is 'to increase its profits so long as it stays within the rules of the game' (Friedman, 1970). Many of the reviewed cases revealed, however, that the regulation which actually constrained corporate decision-making in the face of early warning signals, were far from such an ideal regulatory system. The following paragraphs highlight some key gaps and loopholes of the regulatory framework.

Incomplete information for regulation

First, regulators often do not have the complete information that would be necessary for imposing all appropriate constraints. On the one hand, this is of course due to the high degree of uncertainty or ignorance inherent in the activities, such as currently for nanotechnology or for GMOs. In addition, however, regulatory measures such as legal bans, safety standards or contingency plans often rely on information that is generated within the companies whose products or activities have to be assessed (EEA, 2001). For instance, companies may be the ones to first recognise early warning signals, as exemplified in the famous article of Bill Joy, the co-founder and Chief Scientist Officer of Sun Microsystem, alerting the public about the risks of genetically modified organisms, robotics and nanotechnology (Joy, 2000). Even in the presence of information disclosure rules, it is frequently up to the companies to reveal such 'private information' to the regulatory agencies. Not revealing important information can hence delay or distort regulatory action.

Regulation rarely induces full internalisation of externalities

Apart from their *ex post* role of ensuring justice, liability regimes are meant to provide *ex ante* the incentive for companies to internalise potential harm to society or the environment in their business decisions, to make sure that companies have the financial means for compensation, and to motivate complete risk assessment as well as precautionary measures (Boyd, 1997). In accordance with the 'polluter pays' principle, financial responsibility rules would take the form of strict liability to pay for potential harm. Alternatively, 'assurance bonding' can require companies to deposit a premium that

would cover the costs of potential damage before undertaking the dangerous activity (Kysar, 2009).

In many past cases, however, limited or even complete absence of liability have undermined the polluter pays principle and left companies without economic incentives to internalise external risks. Then, external costs from corporate action are typically borne by society at large. In the case of fisheries (EEA, 2001, Ch. 2) there was no corporate liability in place to account for externalities of overfishing and the costs to restore stock is to be paid by governments of the respective adjacent states. Similarly, the majority of external costs from MTBE in petrol (treatment of contaminated water, alternative water supply, health costs etc.) were borne by society (EEA, 2001, Ch. 11). For asbestos in the United Kingdom, it is argued that the market price of asbestos was so low since it did not internalise the external costs, which remained with families, health service, insurance carriers and building owners (EEA, 2001, Ch. 5). Even though laws on prevention, compensation, and sanctions existed as early as in the 1930s, they were simply not appropriately implemented.

There are other important aspects that determine the effectiveness of liability regimes in steering corporate conduct. For instance, the evidentiary strength to determine when liability comes into effect may be more or less strict, ranging from the need of 'clear and convincing evidence' vs. 'more probable than not' vs. 'preponderance of evidence', or the requirement of a 'substantial cause or factor' vs. 'contributing factor'. In addition, it is crucial whether the legal burden of persuasion is with those who suffer the harm or whether it is the responsibility of the industry to prove that no harm was done (Ashford, 2005). Clearly, a company facing a legal situation in which the victim has to provide convincing evidence that the corporate activity was a substantial cause for the suffered harm can expect fewer costs than in other situations, e.g. in which the burden of proof of no harm lies on the company.

It has also been noted that insolvency risk can further undermine full cost internalisation by companies, especially when harm would only occur in the far future (Boyd, 1997). For instance, Manville Corporation filed for bankruptcy in 1982 as a means of dealing with asbestos pollution claims (EEA, 2001, Ch. 5), when it was far too late to act with precaution towards asbestos.

Conflicting mandates of regulatory agencies

The implementation of a regulatory framework that adequately constrains companies for protecting society from potential hazards requires that the responsible governmental agencies have a clear mandate to do so. Governmental agencies sometimes have conflicting mandates. Before establishment of the US EPA, for instance, the US Department of Agriculture was responsible for environmental regulation in the debate on chemical contamination of the Great Lakes. As a supporter of the economic interests of the agro-industry, it tended to align itself with the pesticide manufacturers and the farmers, demanding proof of causal relationship before 'massive' approbations and expenditures of public and private funds on remedial works' (EEA, 2001, Ch. 12). In a similar fashion, the US Department of Fisheries and Oceans (DFO), which was responsible for reporting the scientific evidence on overfishing, is said to have followed the interests of the fishery sector (EEA, 2001, Ch. 2). The DFO is accused of having presented biased results, referring to remaining uncertainties, and of arguing against 'pseudo-science' and bad faith of early warnings.

Conflicting mandates of regulatory agencies are reported in further instances. In the case of the 'mad-cow disease', the responsible British Ministry of Agriculture, Fisheries and Food (MAFF) was expected simultaneously to promote the economic interests of farmers and the food industry whilst also protecting public health from food-borne hazards (EEA, 2001, Ch. 15). In the debate on the toxic effects of Gaucho, the French Ministry of Agriculture was responsible for the contradictory demands of intensive agriculture and beekeepers and at the same time for the management of risks issuing from the agricultural sector's activities (Maxim and van der Sluijs, 2007, and Chapter 16). The US Department of Energy (DOE) was responsible both for the cheap production of nuclear weapons and the protection of workers through appropriate beryllium exposure limit (Chapter 6).

Corporate influence on regulation

Regulators have in the past not always judged and decided objectively and independently with respect to corporate interests. In several cases, regulatory agencies and committees included experts with a conflict of interest, who could shape policy recommendations by interpreting scientific evidence in the interests of the industry. Again, the tobacco documents have revealed the extent to which industry is able to subvert public institutions. In a report about the strategies to undermine tobacco control activities of the World Health Organization, authors write that 'evidence from tobacco industry documents reveals that tobacco companies have operated for many years with the deliberate

purpose of subverting the efforts of the World Health Organization (WHO) to control tobacco use. The attempted subversion has been elaborate, well financed, sophisticated, and usually invisible' (Zelltner, 2000).

In the case of benzene (EEA, 2001, Ch. 4), the American Conference of Governmental Industrial Hygienists (ACGIH) repeatedly recommended benzene limits higher than those in line with scientific evidence on benzene poisoning. Scientists employed by various corporations participated in the Threshold Limit Value Committee that made exposure recommendations (Castleman and Ziem, 1988). In the early phase of using lead in petrol in the 1920s (see Chapter 3), public health specialists acted as paid consultants to the Ethyl Corporation while at the same time advising the US Government's Bureau of Mines, providing assurances of 'complete safety' for public health. In the pharmaceutical domain, conflicts of interest seem pervasive. Reviewing three European drug regulatory agencies, Lexchin and O'Donavan (2010) find evidence of widespread potential conflict of interests among scientific experts.

Last, companies can also influence regulation indirectly through the above mentioned influence on public perception of the involved risks. In an increasingly demand driven economy, public trust, consumer perceptions or NGOs can have a considerable influence on the politics and decisions of regulatory agencies (Aerni, 2004; Carter, 2002).

25.2.4 Psychological factors

There is ample evidence from the behavioural sciences indicating that people's capacity for proper recognition and evaluation of early warnings is limited. This section outlines prominent findings and assesses their role for business decisions and the perceptions of the general public.

Bounded rationality

A large body of psychological and 'behavioural economics' research is dedicated to the 'bounded rationality' of risk perception and decision-making under uncertainty, (Kahneman and Tversky, 1982). Psychological theories of judgment and decision-making provide a number of explanations for human failure to adequately process risks and probabilistic information. Note that the manifestation of potential hazards may be either described as low-probability events (e.g. a nuclear catastrophe), or, when the scientific evidence of an adverse effect is scarce, the likelihood of the effect will be formulated in terms of a low probability (e.g. the increase of cancer rates caused by exposure to a chemical substance). While low-probability events can be overestimated when they are vivid in people's mind (Kahneman, 2011), it has been shown that awareness of risks is more effectively communicated by engaging in direct experience and the associated emotions, rather than abstract statistical descriptions (Weber, 2006). Also, concrete losses or events have a much higher impact on people's beliefs than information about uncertain, abstract ones (Dana, 2003).

This focus on direct experiences as basis for decisions, however, leads human cognition to struggle with an appropriate consideration of low-probability risks as indicated by early warning signals. When early warnings signals occur, people have typically not directly experienced the hazards themselves. In that case, people tend to neglect the likelihood of rare events (Hertwig and Erev, 2009). As Kahneman (2011) emphasises, 'when it comes to rare probabilities, our mind is not designed to get it quite right. For the residents of a planet that may be exposed to events no one has yet experienced, this is not good news.' The psychological hurdles for a proper recognition and evaluation of early warnings apply to business decision-makers and the general public alike (Boyd, 1997). Note that in exceptional cases, this psychological disposition can trigger an opposite effect, namely when a low-probability event does indeed occur. Then, people may even — at least temporarily — overrate the probability of occurrence (Sunstein, 2003), and increased public concern may lead to faster regulatory measures. This may have been the case for the German decision to phase out nuclear energy after the Fukushima accident in 2011. In most situations, however, human risk perception seems to impede precautionary corporate action as well as public pressure for responding to early warnings with precaution.

A related phenomenon is the so-called 'pensioner's party fallacy', according to which people tend to overrate the fact that some people live long in spite of exposure to harmful substances and are hence still present at pensioners' parties — as opposed to their deceased colleagues — and this presence is perceived as evidence against the existence of harm (EEA, 2001). Here, people neglect the fact that their personal experience with formerly exposed colleagues is biased towards meeting the survivors. For instance, this effect is likely to play a role also for the perception of risks from smoking.

Another well documented characteristic of risk perception is that immediate losses or harm have

a larger bearing on people's beliefs than losses or harm in the future (Dana, 2003; Weber 2006). Economic models capture this systematic bias in preferences over time by using discount factors for present value calculation. Recent 'behavioural economics' approaches even use hyperbolic discounting to represent the seemingly exponential diminishing of value over time. This systematic bias works against precautionary measures since those measures typically involve direct costs in the present in order to avoid uncertain costs from harm in the — often far away — future. One may argue that people should decide freely on their 'time preferences' and that any type of paternalism on how to trade off present versus future consequences is inappropriate. Nevertheless, uncertain future hazards also involve consequences for future generations and discounting such consequences based on the time preferences only of the present generation may be questionable from an ethical point of view (O'Neill et al., 2008). There is currently a heated debate about an appropriate discounting of the effects of climate change and of biodiversity loss (Stern, 2006; Weitzman, 2007; Spash, 2007; TEEB, 2009).

Other findings on the limits to taking into account information about risks are noteworthy. For instance, the 'finite-pool-of-worries' hypothesis reflects that the degree of concern for a certain issue depends on the presence of other, perhaps more direct worries, such as the financial crisis, job security etc. (Weber, 2006). For most people, uncertain future hazards may not be high enough on the agenda to invoke any action. The 'single action bias' reflects the tendency not to take further action after one initial step, which leads to suboptimal behaviour when a portfolio of actions or a constant change in behaviour would be appropriate (Weber, 2006). Moreover, there is evidence for cultural differences in how health and safety risks affects decision-making (Biana and Keller, 1999). Last, even though we have not found psychological studies on the phenomenon, several reviewed cases reported that companies exploited people's tendency to interpret 'no evidence of harm' as 'evidence of no harm' (Chapter 3; Chapter 6; Zelltner, 2000).

Bounded ethicality

Apart from 'bounded rationality' in risk perception, there are psychological findings revealing 'ethical blindness' (Palazzo et al., 2012), 'ethical biases' (Banaji et al., 2003) or 'bounded ethicality' (Gino et al., 2008). A prominent and widely studied phenomenon is the 'self-serving bias', which refers to people's general tendency to interpret ambiguous situation in their self-interest (Babcock and Loewenstein, 1997). For decisions where self-interest conflicts with ethics, this implies that people engage in self-deception that helps them reinterpret or disguise that acting in their self-interest violates ethical principles. Such phenomena can be largely unconscious and psychologists tend to relate them to the reduction of a 'cognitive dissonance' (Festinger, 1957) that stems from conflicting goals such as making profit and acting ethical.

Self-deception may be enabled through different mechanisms, including language euphemisms and 'slippery-slope' decisions, where a series of small infractions of ethical standards can lead to a journey towards immoral conduct (Tenbrusel and Messik, 2004). In addition, people tend to hide from relevant knowledge on ethical attributes of decisions (Ehrich and Irwin, 2005) and to neglect those arguments or types of reasoning that may reveal them as responsible for immoral action (Rode and Le Menestrel, 2011). The self-serving bias seems of high relevance when business decision-makers face uncertain early warnings signals but precautionary measures are not in the economic interest of the company (Gollier and Treich, 2003). Strong uncertainty may not only be inherently difficult to integrate into risk assessment, but it may also serve as a welcome 'excuse' and justification about why the profitable action may not be so unethical after all.

Other research has shown that people tend to engage in self-deception also when evaluating potentially harmful behaviour of others, in particular that they overlook unethical behaviour of others that may harm them when that behaviour is not clear, immediate and direct, and when it has not yet resulted in a bad outcome (Gino et al., 2008). With respect to our analysis, such a tendency may further explain the public lack of awareness of inappropriate corporate responses to early warnings, and hence the public's reluctance to react with potentially supportive actions in their role as consumers, voters or engaged citizens.

For the case of asbestos, Sells (1994) provides testimony of the relevance of self-deception and denial as critical factors for why business actors fail to act with precaution in the face of early warning signals. He cites one of the presidents of Manville Corporation saying that 'the blunder that cost thousands of lives and destroyed an industry was a management blunder, and the blunder was denial. …Manville managers at every level were unwilling or unable to believe in the long-term consequences of these known hazards. They denied, or at least failed to acknowledge, the depth and persistence of management accountability' (Sells, 1994). It is as

if the combination of economic interests, scientific uncertainty, and psychological factors concur to trap business executives in an organisational culture where the danger is minimised and alternative business solutions unattainable: 'If an organisation's culture encourages denial, problems get buried. Corporate cultures are built by successful people, good men and women who are often pillars of their communities as well as business leaders. The executives at Manville were good people too, and nevertheless they fostered a culture of self-deception and denial' (Sells, 1994).

Evidence from the same company, however, also shows that such cultural factors can be reversed. The tragedy of asbestos and the eventual bankruptcy acted for Manville Corporation as a lesson for the company to stop its culture of denial and changed its approach towards products stewardship. In 1986, shortly after learning that its fiberglass products could be related to an increase in cancer rate, the company's leadership took precautionary action with regards to its operations and voluntary re-labeled these products as possibly carcinogenic despite the reluctance of their lawyers. The company benefited from this proactive strategy thanks to a successful indemnification and marketing strategy, proving that what may be perceived as a conflict of interest could well lead to a successful alignment of business and social values. It took then nearly five years to realise that the excess detected in respiratory cancer in fiberglass manufacturing workers were not sufficiently significant to justify such a warning label (Sells, 1994; Paine and Gant, 2009).

25.3 Lessons and reflections about business and early warnings

We now provide a set of lessons and reflections that summarise our findings and whose consideration may promote more precautionary business decision-making.

Lesson 1: early warning signals often entail conflict of values for business actors, who expect to be in their economic interest not to respond with precautionary 'business actions'

The cases we have studied here illustrate that early warning signals often raise conflicts between short term economic gains for business actors on the one hand and long term human health and environmental values on the other. Given that health and environment are regarded as issues pertaining to society at large or at least to multiple societal actors or groups, these conflicts of values are often conflicts of interest between business actors and public interest.

The reviewed cases illustrate how business actors tended to give priority to their short-term economic interest and did not respond to early warnings. This behaviour is in line with the standard economic and management paradigm, which regards maximising profits as the main objective of companies, as long as this is done respecting the relevant regulatory frameworks. In other words, when early warning signals entailed potential conflicts between profit and other societal values, economic interests pushed business to dismiss those business actions that would respond with precaution, such as modifying or terminating potentially hazardous products or operations.

Lesson 2: characteristics of the research environment and the regulatory context can provide business actors with opportunities to enter into 'political actions' to undermine early warning signals

When companies respond to early warning signals by giving priority to their business interest at the expense of public interest, they have a further incentive to suppress, contradict or downplay these early warning signals, both to maintain favourable public opinion and to avoid regulatory constraints. Many of the reviewed cases were characterised by a regulatory and societal context that allowed companies to effectively pressure science, lobby for favourable regulation and influence public opinion against the recognition and acceptance of early warning signals. In some cases, like tobacco, such actions contributed to discrediting national and international institutions and NGOs, weakening their ability to produce or relay early warnings signals. Because these actions go beyond strictly speaking 'business actions' but rather influence the societal context of business, they can be seen as 'political actions' and illustrate a political role of business actors (Scherrer and Palazzo, 2010). It seems therefore important to distinguish these types of actions from 'business actions', such as decisions to continue or not with a potentially hazardous product or operation. 'Political actions' are not aimed at maximising profits within the political and regulatory contexts but rather aim at influencing these political and regulatory contexts in the pursuit of profits.

Lesson 3: psychological and cultural factors contribute to neglecting early warning signals

Business decision-makers face psychological barriers to awareness and acceptance of the conflicts of values and of interest entailed by early warning

signals. Human risk perception and time preferences are biased towards underrating uncertain hazards, and there is a tendency to avoid the cognitive and emotional dissonances generated by the presence of value conflicts. In particular when own interests are at stake, it is well documented that people tend to reveal self-serving biases in their perception of the situation. Hence, when business actors have an economic interest in producing or using potentially hazardous substances, they are tempted to justify their behaviour by dismissing early warning signals and the conflicts of values they entail.

The cultural business context further contributes to the denial of conflicts of values entailed by early warning signals. Typically, the idea that the main objective of business is to maximise profit and the belief that this is the most appropriate way for business to serve society provide a powerful justification for dismissing the relevance of these value conflicts for business actors and to increase self-perception of responsibility. As in the asbestos example, organisational cultures can also explain the difficulty in facing the conflicts of values and of interest entailed by early warning signals.

Reflections about business and early warning signals

A prominent policy response to conflicting interests between business and society are regulatory measures that attempt to steer business rationality towards internalisation of external effects. We would agree that for uncertain hazards, proposals for legal, fiscal, and financial regulatory mechanisms still have a large potential to further align business interests with interests of society. Innovative solutions such as assurance bonding should be considered (Kysar, 2009). Yet, our article has outlined that precautionary business operations face further barriers that are of epistemological, psychological, political and cultural nature. Given the variety and complexity of these barriers, it seems unrealistic to believe that complete alignment of business interests with interests of society at large will always be feasible. At least in the short term, or until business actors indeed face the ideal societal and regulatory context, business decision-makers will face difficult situations with value conflicts. In our opinion, the possibility to discuss these conflicts of values rationally and openly is an absolute necessity to mature our responses towards them.

In particular, and notwithstanding the necessity to strengthen the accountability of business actors, we believe there is a need to better understand and expose the rationale for business actors not to respond voluntarily to early warning signals with precautionary actions. Blaming business, in particular with hindsight, tends to be a rather typical reaction that may not always be constructive. It often misses the complex or even contradictory set of motives and drivers that business actors are facing. When companies give priority to their business interest at the expense of precautionary actions, it is not necessarily because they willingly act against the interests of society or to harm the environment. Some business actors may well acknowledge the need to sacrifice some business interest, but may consider in good faith that the early warning signals are not strong enough to justify precautionary measures. Others may be unaware of the full extent of their conflicting interests and of their self-serving biases, for instance because of a cultural or an organisational context that is trapping them in a short-sighted economic approach.

We thus believe that a crucial first step towards any solution is awareness and acceptance of the dilemmas business actors are facing, and of the various temptations for business to act in a way that is harmful to society. Here, we can imagine that public institutions could support progressive business by analysing and publically disclosing the dilemmas and temptations entailed by early warning signals, e.g. for different industries and for the specific societal and regulatory context of decisions. This includes disclosure of the conflicts between making profit and causing potential societal harm, but also the psychological temptations to hide from such value conflicts, the temptations to use gaps and loopholes of regulation or to influence the regulators, as well as the temptations to influence the scientific evidence. Rather than prescribing specific precautionary business actions, such institutions could then promote more open, transparent, and stakeholder-inclusive participatory decision frameworks that recognise the reality and the difficulty of the complex trade-offs (Stirling, 2008).

Rigorous and explicit exposition of the dilemmas will create further incentives for responsible actors to share and communicate their precautionary responses. Clear and factual descriptions of these difficult situations, if possible devoid of judgemental considerations, may contribute to reducing unconscious denials, force business organisations to openly discuss the factors driving their decision-making (see Tenbrusel and Messik, 2004), and promote more transparency, proactive attitudes and innovative responses to difficult business decisions. Because they would make explicit the conflict of values, such institutional approaches

would more realistically complement initiatives based on the idealised principle that being socially responsible is economically profitable, typical of Corporate Social Responsibility (Porter and Kramer, 2011).

An additional reflection lies more specifically on the role of political actions of business actors, in particular those actions aimed at suppressing early warning signals. Even though they could be regarded as a natural tendency to justify and protect one's own interest, such political actions have the potential to disrupt an honest debate and to prevent the development of an appropriate context within which business actions lead to positive consequences for society. The fact that some business actors spend sophisticated efforts to hide or keep secret their political actions can be seen as a signal that their behaviour is of bad faith and would not be socially acceptable. Regulatory efforts that make more transparent the political actions of business can help to sustain a sound balance of power, thereby maintaining our ability to benefit from early warning signals and reducing the likelihood of health and environmental hazards.

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