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# 'All we have to do is be uncertain': assessing the 'amplification of institutional incertitude' in European food safety and risk governance

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## ABSTRACT

This paper addresses efforts made by the European Food Safety Authority (EFSA) in recent years to foreground the identification, representation, and public disclosure of scientific uncertainty in its risk assessment procedures and communications, a process aptly characterised in this paper as the 'amplification of institutional incertitude'. We argue that while the introduction of EFSA's novel uncertainty reforms has opened a welcome space for academic and policy dialogue, this strategic initiative will nevertheless struggle to reconcile ongoing stakeholder concerns about the legitimacy, direction, and authority of the agency's scientific opinions and expert advice. We observe that the instigation of EFSA's uncertainty reforms is prefigured by a longstanding policy tension running at the heart of the agency's directives requiring officials to be both open and transparent on the one hand, whilst being free from political influence and remaining distanced from risk management decisions on the other. The uncertainty reforms adopted may accordingly be understood as a way for EFSA to reconcile a current 'uncertainty paradox' facing the agency by accommodating wider concerns about uncertainty and opening itself up to further scrutiny of its risk assessment processes without relinquishing independence. We argue that prior policy tensions are unlikely to be resolved by simply 'being uncertain' however, because this prescriptive 'solution' offers only limited congruency with the wider problem diagnoses facing the agency. Moreover, we caution that as institutional incertitude is increasingly amplified, EFSA will in turn be further prompted to rethink and refresh its stakeholder engagement initiatives in order to improve its standing in the food safety field amidst ongoing criticisms and calls for greater inclusion, oversight, and input that follow. Finally, we offer some policy recommendations and highlight the need for future lines of research inquiry to take greater account of the socio-political context in which the assessment and communication of uncertainty takes place.

## KEYWORDS

Uncertainty;  
transparency;  
risk communication;  
food safety;  
European Food Safety  
Authority

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## 1. Introduction

All we have to do is get the numbers right  
All we have to do is tell them the numbers  
All we have to do is explain what we mean by the numbers  
All we have to do is show them that they've accepted similar risks in the past  
All we have to do is show them it's a good deal for them  
All we have to do is treat them nice  
All we have to do is make them partners  
All of the above  
Baruch Fischhoff (1995)

Longstanding questions about the role, importance, and impacts of identifying and conveying uncertainty have received renewed academic and policy interest following reforms made by the European Food Safety Authority (EFSA) in recent years to its risk assessment processes, scientific advisory procedures and communications (Lofstedt and Boudier 2021; Osman et al. 2021). EFSA has taken the notable steps of ensuring both that its risk assessments incorporate information about a wider range of possible uncertainties than previously deemed necessary (EFSA 2018), and that this information is disclosed, such that considerations of how uncertainty figures in agency judgements and recommendations are made public (EFSA 2019a).

These reforms have accordingly been broadly promoted as a means for fostering greater openness and transparency with regards to EFSA's assessments and advice (Aven 2021; Sahlin and Troffaes 2021), but have nonetheless attracted numerous questions and criticisms (Lofstedt and Boudier 2021). Doubts have been raised about the appropriateness of some types of uncertainty newly incorporated, together with concerns that communicating this information could unduly undermine confidence in EFSA's scientific opinion (Lofstedt and Boudier 2021). The associated worry is that by adopting a new focal emphasis on uncertainty these initiatives ('uncertainty reforms') might in turn inadvertently lead to harmful impacts if ostensibly sound risk assessments and safety advice are ignored (Lofstedt and Boudier 2021; Osman et al. 2021). Meanwhile, proponents and critics alike acknowledge that EFSA's bold approach is relatively untried and untested, and moreover, that there is a pressing need for continuing research and discussion to help determine how best to account for the uncertainties inherent to risk assessment and management judgments and decisions (Aven 2021; Lofstedt and Boudier 2021; Osman, Heath, and Löfstedt 2018; Osman et al. 2021).

Adding to these debates, this paper offers a critical assessment of EFSA's introduction of uncertainty reforms by placing this strategic initiative within the broader historical and political context of the agency's emergence, development, and subsequent standing as an expert authority on food safety in Europe. Primarily, we argue that EFSA's focal emphasis on what can be aptly characterised as the 'amplification of institutional incertitude' might be understood to represent an attempt to reconcile historic policy tensions which lie at the heart of EFSA's pivotal role in the EU risk assessment-management interface (see: Levidow and Carr 2007). Which is to say, enduring conflicts over the 'independence, transparency, and objectivity' of EFSA's food safety advice, expertise, and input, have adversely affected the agency's credibility at various times (Demortain and Borraz 2021; Vos 2009), thus requiring the frequent revision and subsequent adoption of new risk communication strategies, eventually leading to the recent uncertainty reforms. However, we caution that the amplification of institutional incertitude does not in itself provide a 'catch-all solution' for enhancing trust and credibility, but rather represents one step in a gradual learning process in the manner of Baruch Fischhoff's well known developmental schema (Fischhoff 1995). As such, we argue that by amplifying institutional incertitude in this way EFSA will only go part way to addressing wider stakeholder concerns, as well as invite additional criticism of its processes and procedures. Subsequently,

EFSA will be prompted into making further strategic risk communication reforms better aligned with targeting stakeholder concerns and demands for greater openness, inclusion, and participation, which are not otherwise easily accommodated or met by widening the scope, transparency, and prominence of uncertainty assessments and information, that is by simply 'being uncertain' alone.

The article proceeds as follows. We first trace the historic emergence and developmental trajectory of EFSA's attempts to establish legitimacy within the European food safety field. We highlight how key events and conflicts, along with enduring policy tensions over the credibility of food safety advice, expertise, and input, have adversely affected the agency's standing, thus requiring the revision and subsequent adoption of new risk communication strategies, eventually leading to and including the recent uncertainty reforms. Next, we outline the difficulties and criticisms associated with these reforms in view of wider research discussion and policy debate on the difficulties of uncertainty communication, and why EFSA's adopted approach might be considered to offer only a limited proxy for wider input and inclusion demanded by stakeholders. Finally, we consider the policy implications of this analysis before concluding with some suggestions for future research to take greater account of the socio-political context in which institutional uncertainty is amplified. To support our analysis, we draw on extant literatures on risk and uncertainty communication, as well as source materials, including strategy documents, press releases, Scientific Committee and Expert Panel Opinions, internal media reviews, agendas and minutes of working group meetings, along with relevant archive material provided in public accounts of EFSA in the media and in public discussion by stakeholders, that are closely associated with EFSA's past risk communication strategies and those activities relating to the recent adoption of the new uncertainty reforms.

## **2. Out of the frying pan: putting the formation of EFSA into context**

In the late 1990s, the European food chain endured an intensely troubled period when several member states experienced major food safety crises, involving domestic, European, as well as global repercussions for health as well as trade and the economy. These were first and foremost the bovine spongiform encephalopathy (BSE) disaster that started in the UK and led to a ban of exports of British beef from March 1996 (Millstone and Van Zwanenberg 2007), notably followed by the dioxin feedstock contamination ('chickengate') crisis that affected Belgium during the spring of 1999, and the Foot and Mouth Disease crisis that plagued the UK in 2001 (Lofstedt 2006). These food safety crises cast serious doubts on the capacity of existing authorities to adequately protect consumer interests, the consequences of which included the wide collapse of public trust (Ansell and Vogel 2006; Lofstedt 2006).

Against this tumultuous backdrop, the creation of a new European food safety agency was primarily intended to prevent the recurrence of past failures and their disastrous effects on the health and confidence of consumers. Subsequently, EFSA was established under the European Union (EU) General Food Law – Regulation 178/2002 with a view to creating a stable environment that would promote a new and more rigorous approach to food safety. The main objectives underscoring this new approach included: first, to separate risk assessment and risk management; second, to adopt 'science-led', or 'science-based', assessments over other approaches (e.g. precaution); and third, to demonstrate a commitment to openness and transparency towards the general public (Podger 2005).

Regarding the first objective, the establishment of an independent agency dedicated to scientific assessment was meant to facilitate the separation of 'science' from 'politics', which had been seen to undermine the effectiveness and credibility of past food safety arrangements at the EU level in cases such as the handling of BSE (Demortain 2008; Groenleer 2014). The new

agency would therefore play a crucial role in distancing 'risk assessment' from 'risk management' while ensuring that EU food safety legislation and policy formation be scientifically informed (Levidow and Carr 2007). In order to deliver on these goals a more centralised scientific advisory agency seemed at the time to provide the best policy architecture to offer robust, timely, objective, and transparent scientific expertise and advice on food safety matters to support risk management practices within the EU (Vos 2009).

Regarding the second objective, regulators were mindful that the food safety crises of the 1990s had exacerbated and extended national regulatory differences that impeded the EU internal market (Alemanno 2007; Levidow and Carr 2007). The creation of EFSA thus precipitated a movement towards unity in Europe, and was closely aligned to the reforms notably taking place at the source of the BSE and Foot-and-Mouth problems in the UK. In the UK, the British government had established the Food Standards Agency (FSA) in 2001 as a way to separate responsibilities for the health of the farming and food industries, and food consumers. With a view to strengthening the quality of the scientific input at the EU level, the establishment of EFSA with the professed aim of providing 'independent' assessments and objective advice on food safety issues was to be similarly based on the 'highest level of scientific expertise' (Groenleer 2014).

A clear signal of the intended move towards coherence and unity was sent on 2 October 2002 when the management board of EFSA nominated Mr Geoffrey Podger, the British FSA's Chief Executive as its Executive Director. The two agencies were founded on a commitment to scientifically based risk assessments, with both depending on external experts to resolve contentious scientific questions. Yet, some marked differences should be noted. The British FSA was based on a 'risk analysis' approach that articulates 'risk assessment, led by science and evidence (and) risk management, the consideration of management options available by policy officials' (FSA 2019). By contrast, the European approach was founded on the idea of a stricter separation of 'science' (risk assessment) carried out by EFSA and 'decision-making' (risk management) carried out by the European Commission, the European Parliament and EU Member States. As such, EFSA's dedication to 'purely scientific advice' envisaged a more limited role for stakeholders compared to its British counterpart. This point was set out by the Executive Director, Geoffrey Podger:

It is (...) rather amusing to note that whereas the UK has consumers on its scientific panels as lay members, this is stoutly resisted elsewhere in Europe, not least by the representatives of EU consumers themselves, who believe it would be interfering with the science. Interestingly also EFSA scientific committees, like other EU Scientific Committees, are wholly open about their findings but their discussions are, and remain, confidential to the participants (Podger 2005:4).

Regarding the third objective, in addition to contributing to the protection of European consumers, the new agency was intended to fulfil a crucial political role in (re-)building public trust in a more effective regulatory system through greater public openness and transparency. A key tool incorporated as part of this process was the improved use of risk communication to keep European stakeholders and consumers better informed (Wardman and Lofstedt 2009). As such, the introduction of Regulation (EC) No. 178/2002 required the agency to ensure that the public and interested parties received rapid, reliable, objective and comprehensible information, that the Authority acted on its own initiative as a risk communicator without prejudice to the EC, and that it worked in close collaboration with the EC to promote coherence in risk information provision where necessary (Alemanno 2007).

A new focus on risk communication was therefore an important part of EFSA's mandate (Podger 2005), and was accordingly shaped by four main priorities (see Gassin and Van Geest 2006):

- Establish the Authority as an expert and trusted source of information on food and feed safety issues (within its risk assessment mandate).
- Promote the Authority's reputation as an organisation dedicated to scientific excellence, independence, openness and transparency.
- Ensure that messages are relevant, understandable and address food safety concerns.
- Enhance the coherence of information on food safety matters across the Community.

In accordance with meeting these priorities, EFSA set out a strategic plan that identified supplementary goals including: understanding consumer and public perceptions of food risk and risks associated with the food chain; bridging the 'gap' between science and the consumer; harnessing the support of key actors in order to reach consumers with pertinent and effective messages; and promoting coherent risk communications across the risk assessment/risk management interface (Gassin and Van Geest 2006).

The initial priorities set down by EFSA's overall strategic approach to risk communication were therefore intended to reflect a cross-section of activities and interests whilst helping to position the agency as an independent, objective and transparent authority of good standing on European food safety matters. Subsequently, in the wake of these reforms, the establishment of EFSA was initially broadly – albeit somewhat cautiously – welcomed by stakeholders within the European food safety domain, but it would soon become apparent that significant challenges lay ahead (Wardman and Lofstedt 2009).

### **3. Into the fire: new tensions amidst ongoing controversies over the Europeanisation of food safety**

Early into its tenure, by the mid- 2000s, the credibility of EFSA and trust in its advice was already quickly starting to be eroded (Levidow and Carr 2007; Vos 2009). This followed growing criticism from politicians within the European Parliament, along with that of NGOs and sections of the media, regarding the direction of EFSA's scientific opinions. A particular focus of concern was EFSA's Panel on Genetically Modified Organisms (GMO) that carries out risk assessments associated with new GMO applications (Wardman and Lofstedt 2009). Following a raft of panel assessments ruling out harms in relation to GMO applications, EFSA became increasingly portrayed as too lenient towards industry interests by way of unduly downplaying uncertainties about the environmental and human health impacts of this novel technology (for a summary of over a decade of criticism see Hilbeck et al. 2020). If any proof was needed, heated criticism over these developments confirmed that despite efforts to separate 'pure science' from 'policy decisions' – and therefore politics – the creation of EFSA did not allow for the return to a 'consensual mode' of regulation in Europe (Löfstedt et al. 2011). Rather, it showed that the adversarial and distrustful environment previously entrenched was not going to be easily assuaged or transformed.

One key aspect that made these problems all the more delicate concerned the lack of unity in Europe regarding the position adopted by EFSA towards the contested issue of GMOs. Instead, the ensuing controversy over GMOs offered an emblematic lesson of how varied national interpretations of scientific evidence could diverge by becoming aligned with competing views on responses to the matter of uncertainty. For instance, some countries, like Spain, drew positive conclusions and embraced the new technology, while others, such as Austria, banned it completely (Hilbeck et al. 2020). Although, in principle, these policy 'interpretations' were not ostensibly intended to challenge the EU scientific assessment and policy process itself, in practice they did (Levidow and Carr 2007). Public discussions, along with

political and stakeholder involvement in the issue, all led to sensibly different orientations on the basis for adopting precaution. This in turn impacted on the focus of communications across the supporting network of national food safety assessment agencies. However, it was also apparent that this variability was not confined to GMOs as similar discrepancies were also becoming increasingly noticeable regarding other crucial food safety issues, such as Bisphenol A and Glyphosate, in which national agencies and member states likewise adopted opposing stances (Lofstedt 2006).

Looking across these developments, one early assessment by Levidow and Carr (2007) characterised the difficulties faced by EFSA in terms of a tension between two 'problem diagnoses' and their corresponding 'policy solutions'. Notably, EFSA was originally conceived and designed to offer advice that was 'independent, objective and transparent'. This was primarily intended to create better integration and harmonisation across the EU by establishing centralised scientific expertise that was 'acceptable to all' and would in theory overcome regulatory unevenness across Europe, thereby reducing court challenges over food product safety (Groenleer 2014). The legitimacy of EFSA was in turn to be established on the basis of the principles of 'excellence, independence and transparency' through which science-based advice would be offered that was functionally separate from risk regulators and managers. However, Levidow and Carr (2007) observe that this inevitably led to a series of conflicts between 'expertise and independence', 'transparency and objectivity', and 'harmonisation and precaution'. So, rather than resolving possible tensions, the regulatory reforms and mandates shaping the new appointment and operation of EFSA both extended them and introduced new problems for policy makers.

In principle, adopting a more technocratic and centralised 'science-based' model had been considered a means to overcoming the problems associated with 'subjective' variations in interpretation and opinion that led to national disagreements and divergences (Demortain 2008). In practice, narrowing expert input and aiming for consensus and standardisation meant that the idealised 'science based' approach followed by EFSA necessarily glossed over several intertwined technical and normative features of risk assessment and management (Demortain 2008; Groenleer 2014; Hilbeck et al. 2020). This included how differences in scientific opinion, which often occur when assessing risk, were necessarily hidden behind the 'consensus' adopted by the scientific panels that in turn was considered necessary in order to avoid stoking possible conflicts amongst Member states and other stakeholders with competing perspectives and interests (Levidow and Carr 2007). There was also criticism that, on the one hand, the experts working for EFSA would inevitably have close prior connections, whether with industry or their home nations, and so could not be considered wholly independent and objective in their views (Hilbeck et al. 2020). On the other hand, in its bid to remain independent, wider societal considerations and counter views had become marginalised from EFSA's considerations, which in turn was argued to limit the broader applicability of its assessments and guidance (Levidow and Carr 2007; Hilbeck et al. 2020). Nevertheless, the alternative solution offered in response to this problem formulation was the pluralised model of assessment and decision making that the creation and design of EFSA was intended to overcome. As a result, EFSA has been confronted with a type of 'catch-22' situation in which the two competing policy problem diagnoses identified are offered as an unsatisfactory 'solution' to each other, while ongoing conflicts over appropriate responses to uncertainty continued to undermine its standing (Levidow and Carr 2007).

One key problem confronting EFSA has been instructively elaborated by Van Asselt and Vos (2008) as the 'uncertainty paradox'. According to these authors, the uncertainty paradox is a feature of modernity that arises in situations whereby uncertainty is acknowledged but the role of science is positioned as providing certainty. In turn, the uncertainty paradox can lead to the elision of key considerations if it is left unresolved. Van Asselt and Vos (2008) assert that the uncertainty paradox had become deeply ingrained in risk advisory and regulation arrangements

surrounding EFSA's operation, which they observed to be underpinned and sustained through the following four key mechanisms:

1. 'Uncertainty intolerance' – in which there is an unwillingness to demand or produce uncertainty information. Subsequently, many possible uncertainties are deemed irrelevant, evaded, or remain unacknowledged, so are not systematically investigated, as when EFSA GMO panel opinions generally indicated that there was no uncertainty of consequence, which might otherwise have triggered extra risk management measures (Van Asselt and Vos 2008)
2. 'Boundary work' – in which 'a symbolic line is drawn between realms' to maintain a separation between science and politics and assign designated roles with asymmetric relations. Here, claims to authority are achieved through self-identification as 'scientific experts' such that discussion with others about uncertainties and their importance can be minimised or avoided altogether. For EFSA, such boundary work was observed in the way the agency was able to disqualify and dismiss stakeholder concerns by retaining its remit to consider only 'scientific' as opposed to 'non-scientific' objections, thus maintaining a distinct separation between risk assessment and risk management questions and considerations (Van Asselt and Vos 2008).
3. 'Equating uncertainty with risk' – in which uncertainty is interpreted as a signal of risk such that the executive task is perceived as withholding, downplaying, and marginalising uncertainty information in order to demonstrate safety and avoid politicisation and challenge (Van Asselt and Vos 2008).
4. 'Technocratic provisions' – in which scientists are put 'centre stage' and have a pivotal, undisputed, critical, and decisive position, such that, as long as scientific consensus is obtained, risk assessors become de facto risk managers. This was observed in criticisms that the EU Commission was in certain cases effectively doing little more than 'rubber stamping' EFSA opinions for example (Van Asselt and Vos 2008).

Van Asselt and Vos (2008) subsequently caution that a failure to break through the uncertainty paradox would inevitably lead to the descent of European food safety governance into 'organised irresponsibility', a condition coined by Ulrich Beck to denote the unwillingness, ill-preparedness, and inability of institutions to deal with risk and its consequences despite having procedures professed to do so (see also: Burgess, Wardman, and Mythen 2018; Mythen, Burgess, and Wardman 2018).

#### **4. An uncertain path: the amplification of institutional incertitude**

Whilst EFSA professed itself to be working openly and transparently, and to ensure that scientific outputs indicated what data and other information – including the 'nature and level of uncertainty' – was relayed (Url 2013), these claims continued to be hotly disputed (Bohn 2018; Chvátalová 2019; Cuhra 2015; Hilbeck et al. 2020). Subsequently, following a long consultative process involving multiple scientists, consultants and stakeholders – culminating in a joint EFSA-BfR (2019) international conference on 'uncertainty in risk analysis' (20–22 February 2019) – EFSA issued its Guidance on Uncertainty Analysis in Scientific Assessments (EFSA 2018), and Guidance on Communication of Uncertainty in Scientific Assessments (EFSA 2019a). These two documents advocated the adoption of more comprehensive 'uncertainty assessments' when providing scientific opinions on food safety related matters to the EU Council and other stakeholders, along with further guidance to scientists on how to assess and communicate a wider array of uncertainties than previously envisaged. For example, scientists at EFSA were newly required to make experimental findings, along with the uncertainties



surrounding each stage of assessment, freely available, as well as to identify and describe individual sources of uncertainty, specify their relative and overall impacts, and disclose how these various uncertainties factored into the scientific outputs and conclusions that they subsequently provided (EFSA 2018).

The application of EFSA's (2018) Uncertainty Analysis guidance accordingly included a general definition of uncertainty which referred to 'all types of limitations in available knowledge that affect the range and probability of possible answers to an assessment question', whether referring to a source, its impact on an assessment, or indeed limits to scientific methods. The guidance also elaborated eight types of 'uncertainty expression' that were considered to provide a framework for the discussion of evidence and the formation of opinion. These included: unqualified conclusions with no expression of uncertainty; a description of a source of uncertainty; a qualitative description of the direction and/or magnitude of uncertainty; an inconclusive assessment; a precise probability; an approximate probability; a probability distribution; and a two-dimensional probability (EFSA 2018).

In turn, the application of EFSA's (2019a) Guidance on Communication of Uncertainty in Scientific Assessments also identified how different uncertainty expressions should be used by EFSA personnel (both risk communicators and assessors) and outlined how these should be tailored according to different target audiences, which were segmented across three levels of interest and expert knowledge referred to as 'entry', 'informed', and 'technical'. The 'technical' level information is provided by assessors, whereas the information provided for 'entry' and 'informed' levels can be produced by communicators as supporting communications. While conducting research and wider consultations into how best to approach these tasks, EFSA (2021) also discerned that the question of 'how uncertainties should be communicated to enable non-scientists to make informed decisions' was an under-researched and inconclusive topic. At the same time, the agency found the knowledge and experience gained during the implementation of its uncertainty reforms to be helpful in providing new insights into communicating different uncertainty expressions in scientific assessments. Following which, EFSA expected to review and update its guidance over the next five years as appropriate (EFSA 2021).

In parallel to the development of these reforms, it is also important to note that, while EFSA has maintained a centralised 'science-led' orientation, it has also expressed a commitment to improving stakeholder engagement and public communications (EFSA 2016). This requirement was made especially salient in light of external criticism and evaluations of its limited past provision in these regards (Wardman and Lofstedt 2009; Hilbeck et al. 2020). Strong, direct risk communications were always deemed to be important especially in the event of food safety crises or controversies. A particular challenge for EFSA concerned the fact that there were often notable differences in food safety concerns between countries, along with significant cultural variations in risk perceptions (Wardman and Lofstedt 2009). Early into its operations, a key plank of EFSA's risk communication strategy was thus conceived as trying to 'influence the influencers' and work with 'information multipliers', such as national food safety agencies, that were thought to be better placed than EFSA to communicate with national audiences (EFSA 2007). This goal was articulated as providing 'science-based information to organisations in direct contact with and trusted by consumers, who are therefore more likely to impact change in awareness, attitude and even behaviours, where required' (EFSA 2007, 34). While scientific information sharing between EFSA and national food safety authorities was initially maintained through an Advisory Forum amongst, other supplementary instruments were later introduced, such as working groups and Declarations, to help prevent diverging opinions and improve collaborations (EFSA 2007). Other communication mechanisms and platforms were similarly incorporated to address the media, such as media briefings, conferences, press releases and statements to help better acquaint journalists with European food safety issues (EFSA 2007). To maintain optimal communications and track impact, EFSA and DG Sanco also commissioned a Eurobarometer survey

to regularly report on consumer risk perceptions across Europe. Engagement with external stakeholders was likewise primarily facilitated using 'consultative platforms', but this provision was subsequently expanded through the later introduction of a more diverse range of initiatives, including an annual forum and bureau, along with targeted roundtables and information sessions (EFSA 2016).

Nevertheless, EFSA's (2016) expressed commitment to greater participation and involvement of stakeholders was bound to be limited both in principle and in practice. In principle, despite calls for greater participatory opening of risk assessment and management – including by EFSA itself – the agency is mandated to remain independent, and therefore to limit the intrusion of political biases and subjective perspectives into its scientific processes. In practice, while EFSA has a legal obligation to work in co-ordination with others, such as the competent national authorities of EU Member States, these parties are not in any case required by law to co-ordinate their communications activities with those of EFSA and continued to oppose opinions at different junctures especially where differences in how to appraise and act upon uncertainty (Hilbeck et al. 2020).

EFSA's uncertainty reforms accordingly arose within this wider context of trying to find a resolution to the problem of conflicting views and communicating a 'common position' among risk assessment agencies and different publics across European, whilst at the same time enjoying limited scope to meaningfully increase external stakeholder participation and inclusiveness within its decision-making processes and procedures in order to reach a consensus agreement. Faced with contradictory goals – scientific vs. societal demands – the uncertainty reforms adopted by EFSA can arguably be seen to represent a 'middle path' (Osman, Heath, and Löfstedt 2018). By helping the agency to create a position for itself at the forefront of a new European 'uncertainty agenda', this positioning makes room for incorporating perspectives in tune with the social and environmental values of diverse stakeholders – thereby placing a priority on taking greater account of uncertainty – whilst at the same time trying to preserve scientific integrity in tune with the agency's core concerns and obligations (Lofstedt and Boudier 2021; Osman et al. 2021).

In many ways, this initiative can also be seen to represent a fundamental attempt by EFSA to break out of the uncertainty paradox described by Van Asselt and Vos (2008). This can be observed in the sense that the uncertainty reforms go some degree towards undoing the four underpinning mechanisms respectively outlined above. More specifically: uncertainty intolerance is superseded by a wider acknowledgement and institutional embrace of uncertainty; boundary work is complemented with greater openness and transparency; equating risk with uncertainty is dissolved in favour of separating risk and uncertainty; and technocratic provision is ameliorated through greater stakeholder provision. In sum, by inverting these mechanisms, EFSA is at least in principle attempting to circumvent the uncertainty paradox through the amplification of institutional incertitude. In the event, the practical feasibilities, delivery, and implications of EFSA's new 'uncertainty led' approach became the focus of research and policy discussions, which we address in the next section.

## **5. Communicating uncertainty: recent advances and enduring difficulties around amplifying incertitude**

Communicating uncertainty effectively is widely recognised to be a key challenge for agencies and institutions charged with assessing and handling risk (Kasperson 2014; Löfstedt et al. 2011; Mythen and Wardman 2016; Wardman 2014; Wardman and Mythen 2016). Amongst many complicating factors, the difficulty of capturing all relevant information, together with the probabilistic components of risk assessments, means that uncertainty is embedded within the implicit and explicit assumptions underpinning risk judgements, decisions, and advice (Aven and Boudier

2020). Deciding what uncertainties to focus on, how much of that uncertainty to impart to others, and in what format, is a cross-disciplinary challenge however, (Mythen and Wardman 2016), which has presented a series of enduring practical dilemmas that have yet to be satisfactorily resolved (Kasperson 2014). Consequently, opinion has quite understandably been divided on how best to proceed.

On the one hand, being candid about what is both 'known' and 'unknown' along with the strength of the knowledge base underpinning risk assertions made is generally understood to be crucial to credible risk communication (Aven and Boudier 2020; Fischhoff 1995; Wardman and Lofstedt 2009; Wardman 2020). This primarily accords with an imperative to provide the essential knowledge people require in order to make informed decisions (Fischhoff 2012; Wardman 2008). Transparent disclosure may also indicate that officials are trying to be truthful and therefore more trustworthy (Van der Bles et al. 2020; Löfstedt and Wardman 2016). Not least of all, experience shows that acting conversely can do more harm than good, as when authority officials make overly confident statements that are then proven to be false, or when information is withheld that later proves to be pertinent (Fischhoff 1995; Leiss 1996; Wardman and Löfstedt 2018). Cases such as the BSE crisis act as a stark warning against attempts to gloss over or misrepresent scientific understandings and how doing so can lead to long-lasting reputational damage especially when people find out they have been deliberately misinformed (Fischhoff 1995; Leiss 1996; Löfstedt et al. 2011). Besides which, attending to uncertainty can also help to ensure that risk signals are not unduly downplayed or underestimated, and that appropriate actions are taken (Fjaeran and Aven 2021; Kasperson et al. 1988; Wardman 2006)

On the other hand, there is the concern that conveying uncertainty might also lead to an agency being perceived as indecisive or ill-informed, which could potentially create doubt about the advice being offered (Boudier et al. 2015; Lofstedt and Boudier 2021). In turn, this might impact on public confidence and inadvertently undermine behavioural adherence to health advice and recommendations that would otherwise help reduce unnecessary harm to the individuals concerned (Balog-Way et al. 2021). Providing large amounts of information about all possible risks and uncertainties can also lead to charges of obfuscation if such information does not seem directly pertinent or helpful to decision-making (Fischhoff 1995). There are therefore also imperatives to be concise and coherent and to provide the most decision relevant information during risk communication (Fischhoff 1995; Wardman and Lofstedt 2009). A further related concern is that becoming too engrossed with all manner of possible uncertainties can lead to an undue preponderance with 'worst case scenarios' to the exclusion of more pressing issues and concrete problems, and so may create or exacerbate counter-veiling risks along with their attendant unintended harms and consequences (Wardman and Mythen 2016).

Similarly, questions also abound concerning what particular range, types and levels of uncertainty to include, along with their associated impacts, when acknowledging and communicating uncertainty (Fischhoff 2012; Van der Bles et al. 2020). It is perhaps surprising therefore that while there is extensive research on judgements and decision-making 'under uncertainty', considerably less attention has been devoted to the practical question of how best to communicate uncertainty than might be expected, and which could otherwise help to serve as a guide to policymakers and health and safety agencies officials. Reviews of extant research have turned up only a limited number of empirical studies, and typically conclude with making a call for more research to be undertaken in this neglected area (see e.g. Frewer et al. 2016). One recent interdisciplinary review addressing the 'state-of-the-art' on uncertainty communication notes that what little research there is addressing this topic is both limited and spread out in disparate disciplines across the sciences (Van der Bles et al. 2019). Even then, amongst the key studies identified, research findings are observed to be highly variable, making it difficult to draw firm generalisable conclusions beyond the need for more robust evidence (Van der Bles et al. 2019). Ambiguous findings regarding how the admission of institutional incertitude is received and interpreted are the norm, such that positive, negative, and/or minimal impacts on participants'

ratings of institutional trust have all been variably evident across research studies (Frewer et al. 2016; Van der Bles et al. 2019).

More recently, some studies have begun to shed further light on this topic, albeit not yet providing declarative guidance one way or the other on the way forward. For instance, one study recently concluded that ‘uncertainty information’ in and of itself does not necessarily adversely impact on trust in health authorities, even for health matters of grave concern (e.g. Van der Bles et al. 2020). Whereas another recent study has cautioned that trust may be impacted depending on the form of uncertainty information presented, especially if this is not handled carefully (Balog-Way et al. 2021). For new entrants into this field of inquiry and practice, it is difficult to draw firm conclusions on how uncertainty information ought to be best characterised and expressed, such that ‘clear, consistent, and understandable messaging’ could be achieved, ‘misunderstandings avoided’, and ‘positive relations’ are maintained (Driedger, Maier, and Jardine 2021; Osman 2021; Van der Bles et al. 2019.) In turn, these dilemmas understandably prompted EFSA to conduct its own research, as well as commission studies by others, to inquire into how best to approach the problem of uncertainty and risk communication more broadly (Etienne et al. 2018; EFSA 2019b; EFDSA et al. 2018; Smith et al. 2019; Smith et al. 2021). This research examined preferences for different uncertainty information formats, but did not conclusively resolve key questions relating to the impacts of uncertainty communication on matters such as understanding and trust (EFSA 2018; EFSA 2019a; EFSA 2019b).

## 6. How uncertain is uncertain enough? Conclusions and future directions

Evaluations of EFSA’s uncertainty reforms have to date have been both constructive and critical. Observers broadly agree that there is a pressing need to improve uncertainty communication both within risk assessments and between assessors and decision makers (Aven 2021; Sahlin and Troffaes 2021). Sahlin and Troffaes (2021) note, for instance, that EFSA’s expansive view of uncertainty is generally in line with recent developments in scientific thought, and that efforts to widen support for this view and offer guidance on the relative strengths and weaknesses of uncertainty analysis in risk assessment are to be welcomed. Aven (2021) similarly concurs that EFSA has contributed some valuable discussion but cautions against some weaknesses associated with the different ways in which probabilities can be characterised as part of this process. Aven (2021) suggests in particular that more attention should be afforded to incorporating the latest conceptualisations of ‘risk’ and ‘knowledge’ into assessments in light of current best practices. Osman (2021) likewise points to the need for further integration with prior methods of uncertainty analysis, with Neil et al. (2021) arguing that uncertainty communication should in any case be underpinned by causal reasoning to offer the most utility. Other critics nonetheless point to wider questions regarding public preferences for uncertainty information on food safety matters, and highlight how these preferences may vary according to such considerations as levels of education and trust in authorities (Lofstedt, McLoughlin, and Osman 2021). This view chimes with research highlighting the importance of social considerations and the role of ‘framing’ in the way uncertainty is presented and interpreted (Schuldt, McComas, and Burge 2021). Meanwhile, Driedger, Maier, and Jardine (2021) offer a cautionary note underscoring how dissonance can easily arise between the ‘ideals’ and ‘realities’ of enacting transparency through uncertainty, emphasising that accurate understandings are often difficult to ensure.

All of which arguably comes back to fundamental questions for EFSA concerning not simply how best to identify and represent uncertainty, but also what practical considerations there are concerning why this is necessary, and what levels of uncertainty are deemed to be acceptable and to offer the most utility to decision-makers and stakeholders in view of competing concerns. Two key issues come to mind when considering these broad questions. First, best practice thinking conventionally follows the view that as levels of uncertainty increase, the

imperative to engage with extended peer-communities also increases, particularly when decision-stakes are high – what might be termed the ‘post-normal science’ framing of the problem of uncertainty (Funtowicz and Ravetz 1990). Second, it can also be remarked that the utility of producing and obtaining uncertainty information might in principle follow the trajectory of an inverted ‘U’ in the sense that as knowledge of uncertainty grows, its value to risk assessors and decision-makers initially increases, but a threshold will be crossed whereby additional uncertainty information becomes increasingly speculative and its value begins to diminish in terms of its practical use and importance, even to the extent that may even become harmful if given too much undue focus (Wardman and Mythen 2016).

These observations carry some important implications for EFSA in its respective tasks. Most particularly, the agency’s ability to engage with its extended-peer community is fundamentally constrained to informing and consulting, as outlined above. In light of Fischhoff’s developmental schema, quoted at the beginning of this paper, EFSA’s strategic progression might thus be understood to be inhibited by never being allowed to meaningfully evolve beyond ‘treating them nice’. This is because the next step – ‘making them partners’ – cannot be fully achieved without a fundamental redrawing of the agency’s institutional remit, responsibilities, and policy machinery. Furthermore, while EFSA has notably made some attempts to break the ‘uncertainty paradox’ highlighted by Van Asselt and Vos (2008) evidenced through extending the scale and scope of uncertainty information it now attends to, as yet there are no formal methods or objective criteria employed by the agency for balancing the potential benefits and downsides of this information against which resulting advice and performance might be judged. As such, we suggest that while EFSA’s uncertainty reforms might be considered quite innovative and have helped to open a welcome space for academic and policy discussion, they are inevitably still confronted by some outstanding difficulties. First, the ‘prescriptive solution’ offered by EFSA’s uncertainty reforms provides limited congruence with the ‘problem’ of ongoing calls for greater openness and input by stakeholders. This is because amplifying institutional incertitude in the manner enacted by EFSA can act only as a proxy to the greater inclusion and input of social and political concerns into risk assessment and decision-making processes demanded by external stakeholders. Consequently, despite finding a ‘middle path’ there is still an ongoing mismatch between the problem diagnosis and the corresponding solution employed. Second, there are unresolved practical barriers and dilemmas serving to frustrate the effective production, use, and communication of uncertainty, which will continue to be difficult for EFSA to surmount. Third, the practical use and value of adding this uncertainty information will continue to be disputed and remain an open question until it has been subjected to further evaluation with respect to its impact and consequences within the political context in which it is performed.

In this paper, we draw attention to how and why EFSA’s strategic approach and institutional processes have mutated through several stages over time with respect to key challenges, events and controversies. These have evolved from an emergent focus on ‘scientific independence’ and ‘transparency’ through to ‘amplifying incertitude’ and widening provision for stakeholder input observed through the recent uncertainty reforms. However, while doing so, we also observe that, as currently formulated, there is still an irreconcilable tension between the directives and strategic imperatives governing EFSA that simultaneously require the agency to focus on the quality and independence of its scientific risk assessments, whilst at the same time being open and held accountable to an extended peer community. These problems arise primarily because this extended peer community has limited formal involvement or authoritative voice within the risk assessment and risk management process. As such, disquiet and consternation has continued, which we suggest will prompt EFSA to look for new means to renew its commitment to openness by various means. The uncertainty reforms – geared around amplifying institutional incertitude – are a novel iteration of this problem formulation and prospective solution, but we suggest it can never quite live up to other stakeholders expectations of more participative

deliberation and substantive input and influence into food risk assessments undertaken by the agency.

The analysis offered by this paper helps to contextualise and draw out the historic, political, and symbolic terrain in which EFSA has tried to occupy a dominant, albeit precarious, position on contentious and routine issues in relation to other actors within the domain of European food safety. We contend that the latest uncertainty reforms might as such be considered another stage in the strategic trajectory of food safety assessment, regulation and risk management in Europe, while newer crises loom and further strategies await development. These observations broadly echo studies elsewhere, which indicate that the context, or 'field' in which uncertainty information is produced will have a bearing on the interpretation of that information and the standing of those who provide it (Wardman 2008; Wardman and Löfstedt 2018). Thus far, it seems fair to conclude that while the crucial knowledge base underpinning the value, use, and communicating uncertainty is growing, firm advice remains elusive, and questions about its impacts are on-going. Further research thus continues to be needed to provide more contextualised understandings and formal guidance. Such research would need to attend to questions regarding the specific socio-political context in which uncertainty becomes an issue of concern, and pay especial attention to the means and ends to which uncertainty is being made public, as judged against the normative expectations and assumptions deemed most pertinent and applicable to that situation (Löfstedt et al. 2011; Wardman 2014; Wardman and Löfstedt 2018). As a consequence, such research should be attuned not only to varied numerical and textual forms that different expressions of uncertainty might take, but also to the situated rationales, understandings and practices, which underpin or frame institutional decisions to foreground uncertainty, substantive input into its production, and its wider impact on public appraisals of risk assessments and risk management and regulation (Wardman 2014).

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