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Scientific literature review on group decision-making models

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Abstract

EFSA commissioned a review of available scientific literature on group decision-making in regulatory science to inform future recommendations for EFSA's panel system. This final summary report presents the results from the literature review that has been performed based on a list of 30 articles, proposed and validated in the 'methodological note' in the kick-off phase of this work. The review covers the following topics: social science theories and models of group decision-making; research on group decision-making in risks assessment, specifically in food safety; research on group decision-making in regulatory science, and group decision-making models adopted by national/EU/international organisations. The findings describe the factors that contribute to effective and efficient decision-making in groups, specific factors to consider for expert panels, some potential shortcomings of group decision-making to take into account, and some final considerations to inform EFSA's evaluation of its panel system.

Key words: group decision-making, expert panels, regulatory science, food safety

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Summary

EFSA commissioned a review of available scientific literature on group decision-making in regulatory science to inform future recommendations for EFSA's panel system. The literature review describes the data and methodologies followed to screen, identify, and select appropriate studies—based on prior identification of key questions and the use of keywords—for answering the specific proposed tasks defined by EFSA. The review gathered data on social science theories and models of group decision-making, with a focus on regulatory science and risk assessment in food safety.

The research was based on a combination of keywords including "decision-making", "social science theories", "regulatory science" and "policy". References were screened based on the title and the abstract, which resulted in 30 papers included in the review. Criteria for inclusion of studies were the topic relevance, the publication in English in peer-reviewed journals, and the availability of full papers. The collected evidence was appraised and structured for subsequent analysis on the basis of the objectives and research questions.

The findings provide information on strengths and weaknesses of the decision-making process/approach in specific historic/institutional contexts. Second, they offer a critical review addressing the relevance and robustness of the group decision-making approach for analysing decisions in general. Third, they describe recommendations on how to organise expert panels or groups of experts/decision-makers to avoid 'bias' or 'pathologic behaviour' (so-called "groupthink") in the decision-making process. Lastly, they discuss and propose specific decision-making approaches to optimise the decision in a certain context/institution.

Many articles highlight the need to change the existing decision-making processes in various institutions, countries, or economic sectors. Changes are usually triggered by crises, a period of institutional reform, or the realisation of the shortcomings of systems that lead to sub-optimal or unsatisfactory circumstances. Such systems are usually characterised by 'rigid role definitions' between institutions and experts, a lack of transparency and opacity of rules, poor dissemination of information, the predominant or exclusive role of the 'scientist' (represented by individual experts) over the 'politician', and a lack of other types of external stakeholders in the problem identification or solution definition process. Groupthink models are useful to analyse the 'pathology' of decision-making processes and provide some recommendations on how to improve them: more transparency, sharing of information among stakeholders, encouragement of critical approach, and consideration of external stakeholder views.

The results of this literature review can serve as knowledge base for EFSA's reflections on the panel system in place and potential changes that could be applied in the future for further strengthening EFSA's science.

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1 Introduction

This final summary report presents the results from the literature review on group decision-making models which has been performed based on a list of 30 articles, proposed and validated in the 'methodological note' in the kick-off phase of this work.

The areas for the literature review identified in the terms of references are covered as follows:

- Social science theories and models of group decision-making (9 articles out of 30);
- Research on group decision-making in risks assessment, specifically in food safety (8 articles out of 30);
- Research on group decision-making in regulatory science (7 articles out of 30);
- Group decision-making models adopted by national/EU/international organisations (6 articles out of 30).

The review has been conducted based on a template agreed upon in the kick-off phase, including the following keys/fields of information:

- Name of the publication
- Objective of the document
- Territorial coverage
- Methodology
- Themes
- Main findings
- Specific elements on group decision-making
- Lessons learnt or recommendations

The research criteria and the research engines used to identify the relevant references are illustrated in the Data and Methodologies section, while Appendix 1 reports the detailed factsheets for 30 articles.

1.1 Background and terms of reference as provided by the requestor

This contract was awarded by EFSA to: t33 Srl and Teleperformance

Contract title: Scientific literature review on group decision-making models

Contract number: OC/EFSA/COM/2021/01-LOT 2

EFSA commissioned a review of available scientific literature on group decision-making in regulatory science to inform future recommendations for EFSA's panel system.

The literature review was required to describe the data and methodologies followed to screen, identify, and select appropriate studies—based on prior identification of key questions and the use of keywords—for answering the specific proposed tasks defined by EFSA.

The literature review was required to gather data on the following:

- Social science theories and models of group decision-making
- Research on group decision-making in regulatory science
- Research on group decision-making in risk assessment, specifically in food safety
- Other group decision-making models adopted by national/EU/international organisations.

In consultation with EFSA, the contractor was requested the following within the scope of the literature review:

- Define the search strings and bibliographical databases to be used in the review.
- Define the criteria for inclusion/exclusion of studies, including a preference for experimental studies, conducted on European populations, recency (i.e. the past 10 years), published in English in peer-reviewed journals, relate to areas within EFSA's remit (food safety, feed safety, animal health, plant health, food-related environmental issues), full papers are available (not only abstracts).
- Collect quantitative and qualitative data.
- Appraise and structure the collected evidence for subsequent analysis on the basis of research questions drawn from the above objectives and to be agreed with EFSA.
- Provide a structured database of the collected literature, amounting to an estimated 25 scientific peer-reviewed studies, indicating strengths and weaknesses of the lines of the evidence.
- Provide a summary report of the literature review.

2 Data and Methodologies

2.1 Data

In the review performed (30 articles), there is a prevalence of references concerning 'Social science theories and models of group decision-making' (30% of the articles); while 27% of the papers were sourced in the category 'Research on group decision-making in regulatory science', 23% in 'Research on group decision-making in risks assessment, specifically in food safety' and, finally, the smallest percentage of texts (20%) belonged to the field of 'Group decision-making models adopted by national/EU/international organisations. Furthermore, there is a clear predominance of case studies (14 out of 30) and literature reviews (12 out of 30), whereas experiments (4 out of 30) are fewer in number.

2.2 Methodologies

The list of references – full paper in English - has been identified based on keywords relevant to the study and the abstract (see Figure 1).

Several search engines were used to locate the texts on the Web, i.e., Google Scholar, ScienceDirect, OpenAIRE, ResearchGate, Academia.edu, Taylor & Francis, and SpringerLink. Most of the research was made on Google Scholar, using a combination of the following keywords.

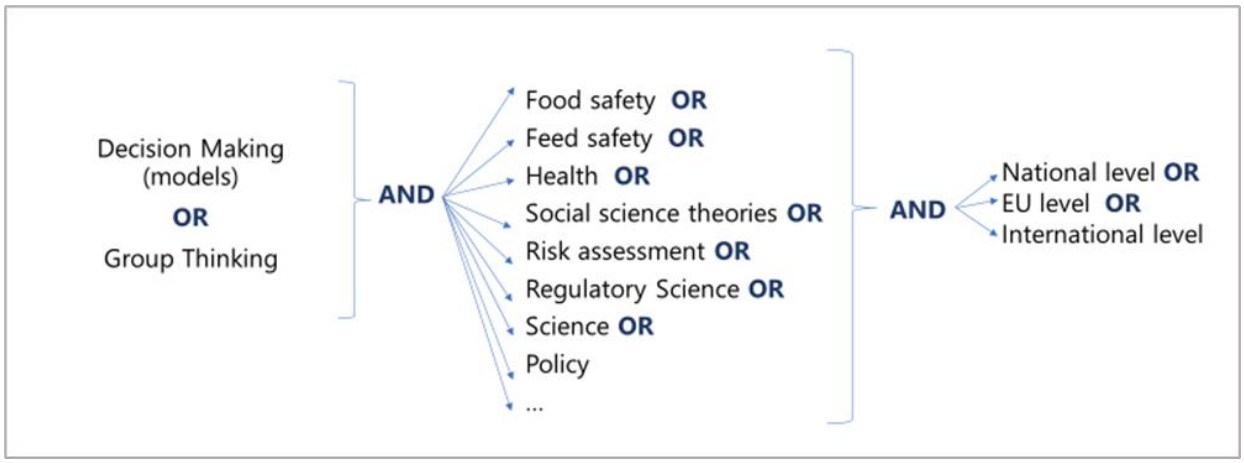

Figure 1: Keywords used for the literature review search.

The research based on a combination of some of the keywords gave the following results:

- "decision making" "food safety" → which gives approximately 162,000 results on Google Scholar
- "decision making" "regulatory science" → which gives 99,704 results on ScienceDirect and 10,500 on Google Scholar
- "decision making" "group thinking" → which gives 1,463,312 results on Academia
- "food safety governance" → which gives 81,208 results on Taylor & Francis Online
- "decision making" "social science theories" → which gives 52 results on OpenAIRE and 9,410 results on Google Scholar
- "decision making" "expert panel"→ which gives 124,000 results on Google Scholar
- "group thinking" → which gives 368,653 results on ScienceDirect and 7,210 results on SpringerLink
- "decision making" → which gives 2,480,000 results on Google Scholar
- "decision making" "sociology" "political science" → which gives 494,000 results on Google Scholar

To narrow the list and make it more focused, other further filtering criteria were used, including:

- Priority to EFSA areas, including food and feed safety, animal health, plant health, and food-related environmental issues.
- Priority to recent studies (past 10 years).
- Priority to experimental studies.

3 Results

Based on the topics, the papers reviewed can be classified into the following four categories (some of the articles cover more than one category):

1. Strengths and weaknesses of the decision-making process/approach in specific historic/institutional contexts;
2. Critical review addressing the relevance and robustness of the group decision-making approach for analysing decisions in general;
3. Recommendations on how to organise expert panels or groups of experts/decision-makers to avoid 'bias' or 'pathologic behaviour' in the decision-making process;
4. Discussion and proposal for specific decision-making approaches to optimise the decision in a certain context/institution.

Many articles highlight the need to change the existing decision-making processes in various institutions, countries, or economic sectors. Changes are usually triggered by crises, a period of institutional reform, or the realisation of the shortcomings of systems that lead to sub-optimal or unsatisfactory circumstances (see Figure 2 for an overview). Such systems are usually characterised by 'rigid role definitions' between institutions and experts, a lack of transparency and opacity of rules, poor dissemination of information, the predominant or exclusive role of the 'scientist' (represented by individual experts) over the 'politician', and a lack of other types of external stakeholders in the problem identification or solution definition process (such as NGOs). Groupthink models are useful to analyse the 'pathology' of decision-making processes and provide some recommendations on how to improve them: more transparency, sharing of information among stakeholders, encouragement of critical approach, and consideration of external stakeholder views.

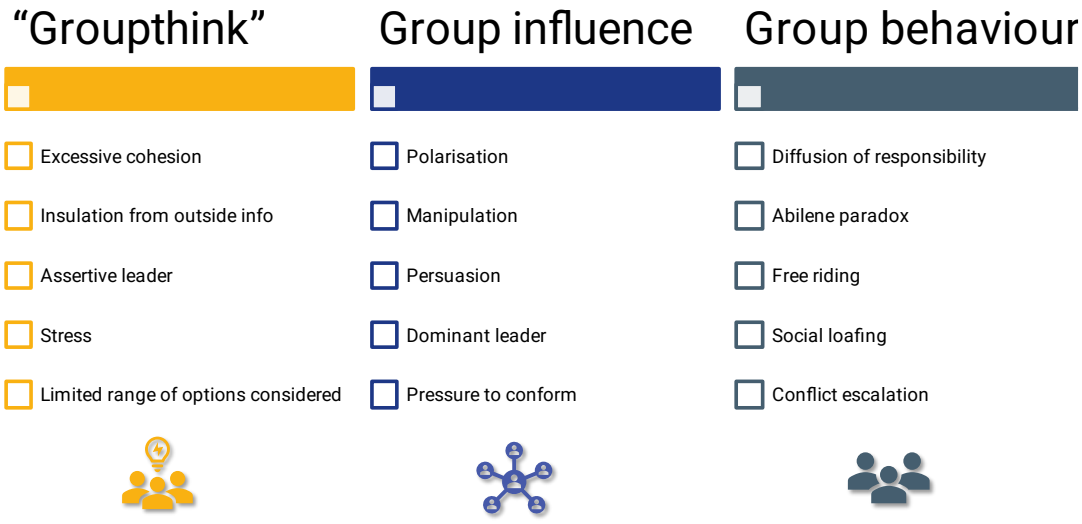

Figure 2: Overview of potential challenges of group decision-making.

The tables below summarise the findings of the literature review by topic category.

Table 1: Strengths and weaknesses of the decision-making process/approach adopted in specific/historic/institutional contexts.

Article (code number)	Findings/conclusions/key content
7	The means and strategies of EFSA are based on a view of aggregative politics as a 'natural state'. This natural state should be smothered or balanced through the prevention of members bargaining between fixed, diverse interests and strategies.
11	Most productive collaborations have been identified as those in which participants directly engage one another's thinking. The presence of conflicting positions has been identified as a productive factor, notably when both are incorrect.
17	The analysis demonstrates that the ERA framework should rather be considered as a pragmatic set of tools that provides a systematic approach to determining risk rather than an evidence-based foundation for decision-making.
19	PSM (Public Service Motivation) has no explanatory value of decision-making in situations in which values are conflicting; PSM alone is not sufficient to explain how individuals will act; PSM might not be universally applicable to individuals belonging to specific professions.
23	The processes of domestication (i.e. the shaping of the practical implementation of participation) have clearly changed the impact of participation on policy outcomes. Public participation is unlikely to succeed without being domesticated to fit the 'institutional rationales' (the institutional logic) of science-based policies.
30	The author argues that medicines evaluation relies not solely on the qualitative assessment of quantitative data, but it also involves many different types of knowledge: knowledge about firms' past and present strategies, about patients' needs and future behaviour, about the state of research and clinical practices, and about legal and policy-making issues.

Table 2: Critical review addressing the relevance and robustness of the group decision-making approach for analysing decision-making in general.

Article (code number)	Findings/conclusions/key content
5	The decision outcome is highly dependent on the composition of the group and the group members' ideas and perception of it.
6	Group dynamics can contribute to more efficient decision-making. The possibility of pooling information and experience among group members can improve decision-making. This is because group discussion can play a corrective function if members individually have incomplete and distorted information: the information of the group as a whole can fill this gap.
12	The managerial representation of the organisational world cannot be considered as the only representation because it does not allow to understand how organisation theory is an important part of a particular philosophical and historical context.
13	Groupthink is a powerful social phenomenon where the experienced momentum of a group takes it to extreme places. Social psychologists have documented the many ways in which group pressures can create conformity and how such "momentum" can result in remarkably poor decisions that fail to take other perspectives into account.
16	Panel discussions demonstrated that, while scientific expertise is essential to provide the necessary knowledge for good decision-making, science cannot operate in a policy vacuum. Without policies, science may produce data that are unnecessary for risk assessment and data that are not relevant for basic research.
20	In order to improve the quality of group decision-making, one must focus on eliminating information asymmetry.

29	Scientific experts are organised or consulted for various reasons: neutrality, objectivity, either 'knowing more', or to demonstrate their representation for reasons of credibility of the regulation process.

Table 3: Recommendations on how to organise expert panels or group of experts/decision-makers in order to avoid 'bias' or 'pathologic behaviour' in the decision-making process.

Article (code number)	Findings/conclusions/key content
1	Food safety policy should, and will, be made by "independent" agencies advised by "independent scientific experts" and their procedures should be transparent. Making explicit the uncertainties and diversity of scientific opinions would help make the process of risk policy development transparent. Moreover, it would help to ensure that the different roles of scientific advisors and policy-makers are clearly and appropriately identified and differentiated, and that each group is properly, but separately, accountable for its judgments and decisions.
3	It would be beneficial for food companies to understand which individuals have the best theoretical and practical knowledge of the HACCP Principle application and to give these individuals the role of 'HACCP Process Facilitator' within the HACCP team. It would be beneficial to make sure that there are enough high-performing individuals within teams to 'balance out' lower-performing individuals.
21	Scientific representations of food safety risks are influenced by previous evaluative judgments, even if risk assessors and managers choose not to recognise this. If risk assessors explicitly recognised the uncertainties as well as the ethical and political assumptions that guide their scientific assessments, then scientific and democratic legitimacy could be achieved more effectively through decision-making processes.
24	The analysis of different types of organisational cultures allowed to highlight the fact that an ideal team would include a combination of mission and involvement cultures, as well as task culture and relationship culture. The combination of all these behaviours within a team would improve its internal communication, develop the competencies of its members, and therefore allow the objectives to be better achieved.
27	The three essential processes to facilitate decision-making are 1) Sharing - communicating knowledge, competencies, opinions or creative thoughts of one team member to other team members; 2) Co-construction – team members engage in repeated cycles of acknowledging, repeating, paraphrasing, enunciating, questioning, concretising, and completing the shared knowledge, competencies, opinions or creative thoughts; 3) Constructive conflict - process of negotiation or dialogue that uncovers diversity in identity, opinion, etc. within the team.

Table 4: Discussion and proposal for specific decision-making approaches to optimise the decision in certain contexts/institutions.

Article (code number)	Findings/conclusions/key content
2	The best model for food safety is the integrated model which provides governance actors with a broad conceptualisation of possible food safety issues, while emphasising dialogical risk communication and deliberative public participation, which can contribute to more resilient governance systems. Decision-making that is based on dialogical and deliberative processes, at all phases of the model, can strengthen the legitimacy and lead to better food safety outcomes.

4	Forum characteristics, such as openness, balanced participation and a professional norm-driven focus on empirical issues, facilitate policy learning. Steps that could be integrated are: • incentivising long-term forum participation (perhaps by focusing the core activities of the forum around the problem-solving mission), and segmenting networking functions at different events and venues may help to maximise learning benefits. • maximising activities that expose forum participants to novel academic research in settings where professionals are less concerned about their stakeholder affiliation and reputation during discussions.
8	One of the best ways to integrate change risk management into successful project management requirements analysis processes is to encourage people to work together in solving business problems and achieving results. All stakeholders have to formulate a solution to model the customers' requirements and conform to what is expected. Another important element that facilitates decision-making is the fact of having the same organisational culture.
9	The proposed method of analysis allows for quantifying the agreement between the experts and categorise these experts according to their opinions. This procedure allows to face the discrepancies instead of hiding them behind a statistical mean or a forced consensus. The proposed method can identify techniques that show a high degree of discordance between experts, and those with higher concordance.
10	Individual thinking is mediated by internalised social interaction. Researchers have identified a new method Group Thinking Measure which, combined with qualitative video analysis, allowed to highlight how the non-verbal and social component is one of the main reasons for successful group thinking.
14	To obtain the best risk estimates by participants in the decision-making process, groupthink must be eliminated. An effective means to do so is to let members make their selections by anonymously voting.
15	Representative deliberative processes are one of the most innovative methods of fostering citizen participation in government. Good practice principles are intended to be the starting point for public decision-makers wishing to commission deliberative processes, and for practitioners wishing to design and organise them.
18	Virtual expert panels can be useful to P&T (Pharmacy and Therapeutics) committees. Used appropriately, there are several potential benefits.
22	The tension within regulatory science between rule-based standardisation (as demanded by international governmental and industrial institutions) and flexible models of innovation and scientific inquiry (which the same institutions claim to value) represents a major challenge for scientific regulatory bodies.
25	Instead of gaining more knowledge about uncertainties, alternative management strategies, such as manageable human interventions, could be proposed. Additional and stricter control, to the point of avoiding any risk as a precautionary measure, could be detrimental to progress.
26	The main message is that expert judgements must be considered as data and, as such, the methods used to obtain and work with this data (i.e. Expert Knowledge Elicitation, EKE) must be such as to maximise the reliability and validity of the data (as it is the case with any empirical method). There are several ways to ensure the reliability and validity of expert judgement, most of which are not mutually exclusive and can therefore be combined.
28	Asynchronous communication seems to be the most efficient means of interaction in non-collocated groups. In comparison to collocated groups, asynchronous groups may experience benefits by allowing participants to focus on a wider range of issues, pool more information together, and discuss multiple issues in a parallel fashion.

4 Conclusion

Group decision-making in expert panels ensures that decisions are based on scientific knowledge, following the principles of neutrality and objectivity, therefore increasing the trust and credibility in the final outcome.

In general, the essential factors analysed in the literature review contributing to efficient group decision-making are sharing, co-construction and constructive conflict. Additional facilitating factors that have been studied are group reflexivity, group activity, boundary crossing, and storage/retrieval of the shared knowledge and ideas that result from the group learning. Other relevant factors that have been explored in the literature are psychological safety, group efficacy, interdependence, and individual capabilities (see Figure 3 for an overview).

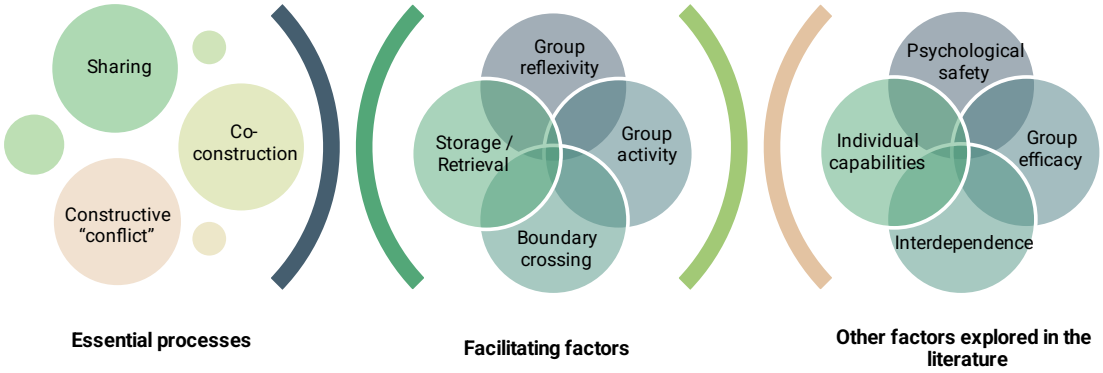

Figure 3: Overview of facilitating factors of group decision-making.

The literature review identified some best practices to consider more specifically for expert panels, e.g., holding open sessions, consider all viewpoints, document the work, explain how and why conclusions were reached and uncertainties. Furthermore, some guidelines have been developed in the context of deliberative processes for public decision-making. These highlight the need to have a clear purpose, be accountable, transparent, ensure representativeness and inclusiveness, provide access to information, and having sufficient time for decisions, among others. Lastly, some papers focused on virtual panels and provided some advice on how to best make decisions in this format. The advantages that virtual panels could provide are related to the possibility to hold asynchronous communication through emails and anonymous evaluation of alternatives. Importantly, in order to be efficient, discussions need to be facilitated with a proper and clear structure and members need to receive an incentive for their participation.

Group decision-making is beneficial for reaching a scientifically robust decision in regulatory science, however it is worth being aware of some of the shortcomings that group-decision making can face. First, "groupthink", a mode of thinking that people engage in when they are deeply involved in a cohesive group and members striving for unanimity override their motivation to realistically appraise alternative courses of action. Second, the influence that the group can exert on individuals, in terms of polarisation of viewpoints and pressure to conform. Third, specific behaviours that can be observed in groups, e.g., diffusion of responsibility and conflict escalation.

5 Recommendations

The results of this literature review can serve as knowledge base for EFSA's reflections on the panel system in place and potential changes that could be applied in the future for further strengthening EFSA's science.

Some considerations for future discussions might revolve around four topic areas described in the literature.

First, the group size of the panels, as research has shown that a large number of participants could limit meaningful face-to-face interactions and therefore have a negative impact on the efficiency in decision-making.

Second, group consensus, as research has highlighted that not requiring group participants to reach a consensus could positively influence efficiency. Alternative methods such as statistical data modelling of individual panellists' responses could be adopted instead.

Third, group tenure, defined in the literature as "the average number of years each member has worked in the group". Findings stemming from the review point out that membership change in recently formed groups could have positive effects, whereas effects could be negative for long-term groups.

Fourth, anonymity or the use of "pen names" or user IDs could foster more dynamic and rich discussions, as participants might feel more comfortable in sharing their points of view and evaluate other members' contributions without bias based on the person who shared that opinion.

References

Apostolopoulos C, Halikias G, Maroukian K and Tsaramirsis G, 2016. Facilitating organisational decision making: a change risk assessment model case study. Journal of Modelling in Management, 11(2), pp.694-721.

Bolger F and Wright G, 2017. Use of expert knowledge to anticipate the future: Issues, analysis and directions. International Journal of Forecasting, 33(1), pp.230-243.

Brodbeck FC, Kerschreiter R, Mojzisch A and Schulz-Hardt S, 2007. Group decision making under conditions of distributed knowledge: The information asymmetries model. Academy of Management Review, 32(2), pp.459-479.

Chwalisz C, 2020. Good practice principles for deliberative processes for public decision making. in Innovative Citizen Participation and New Democratic Institutions: Catching the Deliberative Wave, OECD Publishing, Paris.

Da Vinha L, 2013. Group-sharing, not Group-think: Understanding foreign policy decision-making through a Social Sharedness Approach. Perspectivas-Journal of Political Science, 11, pp.31-53.

Dalal S, Khodyakov D, Srinivasan R, Straus S and Adams J, 2011. ExpertLens: a system for eliciting opinions from a large pool of non-collocated experts with diverse knowledge. Technological Forecasting and Social Change, 78(8), pp.1426-1444.

Decuyper S, Dochy F and Van den Bossche P, 2010. Grasping the dynamic complexity of team learning: An integrative model for effective team learning in organisations. Educational Research Review, 5(2), pp.111-133.

Faulkner A and Poort L, 2017. Stretching and challenging the boundaries of law: varieties of knowledge in biotechnologies regulation. Minerva, 55, pp.209-228.

Gualotuña Parra JA, Tarquis AM, Grau Olivé JB, Colombo Speroni F and Saa-Requejo A, 2021. An analytical approach to assess the influence of expert panel answer on decision making: The case of sustainable land use in ribadavia banda norte, salta (Argentina). Sustainability, 13(12), p.6705.

Hatton RC, Gonzalez-Rothi RJ, Smith WD and Knudsen AK, 2005. The use of virtual expert panels: formulary decision-making in the 21st century. Formulary, 40(3).

Hauray B, 2017. From regulatory knowledge to regulatory decisions: the European evaluation of medicines. Minerva, 55(2), pp.187-208.

Henriques G, 2020. Groupthink and the evolution of reason giving. Groupthink in Science: Greed, Pathological Altruism, Ideology, Competition, and Culture, pp.15-25.

Hokanson KE, Ellstrand N and Raybould A, 2018. The integration of science and policy in regulatory decision-making: Observations on scientific expert panels deliberating GM crops in centers of diversity. Frontiers in Plant Science, 9, p.1157.

Irwin A, Rothstein H, Yearley S and McCarthy E, 1997. Regulatory science—towards a sociological framework. Futures, 29(1), pp.17-31.

Klintman M and Kronsell A, 2010. Challenges to legitimacy in food safety governance? The case of the European Food Safety Authority (EFSA). European Integration, 32(3), pp.309-327.

Kuhn D, 2015. Thinking together and alone. Educational researcher, 44(1), pp.46-53.

Mikulsen M and Diduck AP, 2016. Towards an integrated approach to disaster management and food safety governance. International Journal of Disaster Risk Reduction, 15, pp.116-124.

Millstone E and Van Zwanenberg P, 2002. The evolution of food safety policy–making institutions in the UK, EU and codex alimentarius. Social Policy & Administration, 36(6), pp.593-609.

Millstone E, 2007. Can food safety policy-making be both scientifically and democratically legitimated? If so, how?. Journal of Agricultural and Environmental Ethics, 20, pp.483-508.

Mondou M, Maguire S, Rahman HT, Pain GC and Hickey GM, 2022. Policy forums and learning in fields underpinned by regulatory science. Environmental Science & Policy, 137, pp.349-358.

O'Connell D, 2019. Reducing groupthink and improving decision-making in risk workshops. Governance Directions, 71(8), pp.449-456.

Őnday Ő, 2016. Human resource theory: From Hawthorne experiments of Mayo to groupthink of Janis. Global Journal of Human Resource Management, 4(1), pp.95-110.

Rothstein H, 2013. Domesticating participation: Participation and the institutional rationalities of science-based policy-making in the UK Food Standards Agency. Journal of Risk Research, 16(6), pp.771-790.

Schott C, Van Kleef DD and Steen TP, 2018. The combined impact of professional role identity and public service motivation on decision-making in dilemma situations. International Review of Administrative Sciences, 84(1), pp.21-41.

Sharman N, Wallace CA and Jespersen L, 2020. Terminology and the understanding of culture, climate, and behavioural change–Impact of organisational and human factors on food safety management. Trends in Food Science & Technology, 96, pp.13-20.

Syberg K and Hansen SF, 2016. Environmental risk assessment of chemicals and nanomaterials—The best foundation for regulatory decision-making?. Science of the Total Environment, 541, pp.784-794.

Tindale RS, Kameda T and Hinsz VB, 2003. Group decision making. Sage handbook of social psychology, pp.381-403.

van Rijssen FWJ, Eloff JN and Jane Morris E, 2015. The precautionary principle: Making managerial decisions on GMOs is difficult. South African Journal of Science, 111(3-4), pp.1-9.

Wallace CA, Holyoak L, Powell SC and Dykes FC, 2012. Re-thinking the HACCP team: An investigation into HACCP team knowledge and decision-making for successful HACCP development. Food Research International, 47(2), pp.236-245.

Wegerif R, Fujita T, Doney J, Linares JP, Richards A and Van Rhyn C, 2017. Developing and trialing a measure of group thinking. Learning and Instruction, 48, pp.40-50.

Appendix A – Factsheets literature review

Factsheet 1

Name of the publication	Millstone E and Van Zwanenberg P, 2002. The evolution of food safety policy–making institutions in the UK, EU and codex alimentarius. Social Policy & Administration, 36(6), pp.593-609.
Objective of the document	The paper traces the evolution of the British food safety system before and after the Bovine Spongiform Encephalopathy contamination scandal in 1996. This paper outlines some of the most important aspects in which national and international authorities have changed the ways in which they assess and manage the risks to human consumers of foodborne hazards. The discussion focuses on the case for separating the responsibilities for regulating and sponsoring the agricultural and food industries, for conducting risk appraisals and decision-making in open and democratically accountable ways and for drawing on experts representing a wide range of interests and expertise rather than on a narrow industry-based group.
Territorial coverage	The paper focuses on the national UK authorities involved in the BSE outbreak, therefore the territorial coverage is in mainly Great Britain. The EU level and the global level are also mentioned through the functioning and role of the Codex Alimentarius Commission.
Methodology	Case study
Themes	Science for policy Health, environment, food, sustainability
Main findings	The article primarily describes the case study of the emergence of BSE contamination in Great Britain in 1996, which caused a serious loss of confidence in national and international food safety authorities. In the first part, the article describes the main structural and procedural features of the British food safety policy-making system taking place in the years between 1960 and 1990 (The 'Ancien Régime'). It highlights how the institutions responsible for setting consumer protection standards – the Ministry of agriculture in the UK, the Codex commission and DG III in the EC - were also responsible for industrial sponsorship of food and agricultural industries and/or trade promotion. Furthermore, policy decisions were made based on advice from small, closed groups of scientific experts, many of whom came from the industries and companies whose products were being regulated. 'The regulatory regimes operated under conditions of official secrecy and lacked proper mechanisms of accountability, some even relying on non-statutory bodies and procedures 'official secrecy'. In addition, there was a confusion of roles between scientific expertise and political decisions: 'Scientific advisors were often expected to take decisions about which risks were acceptable and how they should be managed, even though those decisions needed political rather than purely scientific judgments. The second part highlights how the BSE crisis changed the situation and led to a wave of institutional reforms, including the creation in the UK of the FSA (Food Standards Agency) responsible for consumer protection and public health aspects of food policy. The crisis also led, in 2000, to "the establishment of a new integrated statutory framework covering the EU's entire food chain "from the farm to the fork" and the creation of a European Food Authority (EFA, later EFSA) to provide authoritative, independent science-based advice to the Commission". The last part of the paper underlines how this crisis brought a new rhetoric in the European Union which affirmed that food safety policy should be made by independent scientific experts and their procedures should be transparent.

Specific elements on group decision-making	Explaining the uncertainties and diversity of scientific opinions during the risk policy formation process aids the policy-making process and helps to ensure that the different roles of scientific advisors and policymakers are clearly and appropriately differentiated and that each group is properly but separately responsible for their judgments and decisions. Doing so would lend greater scientific and political legitimacy to the decision-making process and reduce the difficulties faced by scientific and political advisors.
Lessons learnt or recommendations	The analysis of the case study reveals the need to separate the regulatory and sponsoring responsibilities of the agricultural and food industries, to conduct risk assessments and decision-making in an open and democratically accountable manner, and to draw on experts representing a broad range of interests and expertise rather than a narrow industry-based group → Need to unite scientific and democratic legitimacy. Other recommendations in this article are those derived from the FSA guidelines: • committees operate as much as possible in open sessions; • advisory committees ensure that no untoward viewpoint is ignored or neglected and that unorthodox and opposing scientific viewpoints are also taken into account • the work of the committee is properly documented • the committee's decisions include the differences of opinion that emerged during the discussions and why the conclusions were reached, even if alternative views were expressed • all assumptions and uncertainties inherent in the conclusions of these opinions are explained.

Factsheet 2

Name of the publication	Mikulsen M and Diduck AP, 2016. Towards an integrated approach to disaster management and food safety governance. International Journal of Disaster Risk Reduction, 15, pp.116-124.
Objective of the document	The paper explores conceptual underpinnings in a search for ways to strengthen risk communication and public involvement in food safety governance. Exploring the intersection between the essential components of the disaster management cycle with those of a leading food safety governance framework allowed the authors to develop a more comprehensive and integrative conceptual framework. In particular, the framework streamlines the management phase of food safety governance with the mitigation phase of the disaster management cycle, allowing deliberative risk communication actions to mitigate potential food safety disasters and enabling governance actors to consider a broader range of food safety issues.
Territorial coverage	Although the model investigated refers mainly to the Canadian model, the paper can be generically related to any geographical area, thus not to a specific territorial context.
Methodology	Case study
Themes	How to integrate new ways of working Health, environment, food, sustainability Citizen's involvement in the decision-making process Communication and interaction with the Public
Main findings	The paper begins with a description of Canadian food safety institutions. In Canada, three federal regulatory agencies are central governance actors: Health Canada, the Canadian Food Inspection Agency, and the Public Health Agency of Canada. Health Canada is responsible for the formulation of policies and regulations (see for example the Food and Drug Act), while CFIA oversees the programs of inspection, and the Public Health Agency is involved in health protection and policy responses to emergencies.

In section 2, the article follows with a review of models of governance in the food safety sphere: 'technocratic', 'decisionist' and 'inverted decisionist', and the 'co-evolutionary' models are considered. 'The intersection of science and politics and scientific legitimacy and democratic legitimacy is at the heart of the governance' models:

- 'Founded on empiricism and underpinned by the legitimacy and authority of science, the technocratic perspective views only experts as possessing the requisite skills and objective reasoning to produce knowledge from facts';
- 'In the decisionist model, elected representatives, informed by socio-economic, political, and ethical considerations, provide the parameters (choice of policy goals) within which experts determine appropriate courses of action (experts with facts select the means). The inverted decisionist model features essentially the same decision-making processes but inverts their order with experts setting goals and policy makers selecting the means';
- 'In the co-evolutionary model, communication flows in a multi-directional fashion. The model recognises that scientific deliberations are not insulated from social, institutional, or cultural contexts, as it is typically assumed under the technocratic and decisionist models. The co-evolutionary model views communication as a continual process that requires reflexivity on the part of all actors and at all stages of the decision-making process. The co-evolutionary model of governance emerged from a need to acknowledge values and subjectivity in the decision-making process'.

It is pointed out that Heath Canada's policy approach to food safety management is technocratic. "Food safety in Canada comes closest to meeting the requirements for a technocratic regulatory policy style even though the institutional framework does not concentrate decision-making authority concerning food safety in a single ministry…The framework facilitates a technocratic regulatory policy style because officials within Health Canada do their work generally free of parliamentary pressure."

In section 3, a 'food safety governance model' that emphasises risk communication, and public participation and highlights the importance of dialogical communication and deliberative participation is presented. The framework of food safety governance consists of four stages of risk analysis (see figure). 'In the framework, there is a place for both scientific and lay participants to exchange perspectives at each of the governance stages. While experts, on one hand, develop quantifiable risk probabilities and lay people on the other hand hold qualitative-based values, the latter's inclusion in the decision-making process is possible'.

Then, the article discusses how the public can be involved in the decision-making process based on a literature review. In section 4, a comparison is made between the food safety and disaster management cycle.

Then, in section 5, an integrated model for food safety is proposed. 'We propose a broadly encapsulating, integrated model for food safety that fuses the framework of food safety governance with the disaster management cycle'. 'The model consolidates the elements of food safety and food disaster decision making, while enabling communication and public participation under- takings to cover a broader range of issues and activities than conceptually considered in the discrete models. The integrated model seems to apply particularly well to the existing Canadian institutional context, in which Health Canada, the Canadian Food Inspection Agency, and the Public Health Agency of Canada occupy distinct roles. 'Each of these entities has particular objectives that require its involvement in food safety decision making at different points within each element of the model'.

	Finally, the article is also given a critical review of how the Federal governance system should have faced the listeriosis outbreak in 2008. 'Furthermore, as noted earlier, the listeriosis crisis demonstrated how the food safety agencies were ill-equipped to deal with issues outside their locus of expertise. Providing agencies with the conceptual and practical tools to transition between food safety governance and disaster management could enable greater inter-agency coordination. Better coordination could create synergies and avoid duplication thereby making communication and public participation activities easier, less expensive, and more effective (relative to the alternative scenario where food safety governance and food safety-related disaster management are uncoordinated pursuits).
Specific elements on group decision-making	The co-evolutionary model is the approach that more than all makes food safety decisions both scientifically and democratically legitimate. The model recognises that scientific deliberations are not insulated from social, institutional, or cultural contexts and it views communication as a continual process that interests every stage of the decision-making process. A different framework is formulated building on the co-evolutionary model. This framework focuses on communication and public participation as the core of all safety governance stages (framing, assessment, evaluation, and management), which are expressed, respectively, in the form of continuous public communication about processes and results, and feedback from stakeholder knowledge and values → the integrated model for food safety.
Lessons learnt or recommendations	"Providing communities with the conceptual and practical tools to move from food safety to disaster management could allow for greater inter-agency coordination, which could create synergies and avoid duplication, thus making communication and public participation easier, less costly, and more effective (compared to the alternative scenario in which food safety governance and disaster management are uncoordinated activities)."

Factsheet 3

Name of the publication	Wallace CA, Holyoak L, Powell SC and Dykes FC, 2012. Re-thinking the HACCP team: An investigation into HACCP team knowledge and decision-making for successful HACCP development. Food Research International, 47(2), pp.236-245.
Objective of the document	This research provides insight into HACCP (Hazard Analysis and Critical Control Points) team decision-making processes and identifies potential limitations within HACCP team operation that need to be understood by food companies. The findings challenge traditional views of the HACCP team and propose approaches to team selection that will maximise HACCP development success.
Territorial coverage	This study was performed at five manufacturing sites of a multinational food manufacturer, across three of its operating countries (India, Australia, and Singapore).
Methodology	Experiment
Themes	Health, environment, food, sustainability How to integrate new ways of working
Main findings	The article begins with the definitions of HACCP teams. The HACCP (Hazard Analysis and Critical Control Points for Food) system is a model that periodically establishes globally applicable general food requirements and characteristics, often used by countries for their national regulations. One of the preliminary steps for the application of the HACCP method is the setting up of a HACCP team, which must be composed of experts in the field and must have multidisciplinary competencies to guarantee a higher level of food safety.

	The team approach is seen as the most appropriate for the effective development of the HACCP system. "Reasons for use of teams within business organisations include beliefs that team performance will surpass individual performance when the task requires a variety of skills judgment and experience". Then the article underlines that the main shortcoming of this system is that HACCP system members are usually selected for their operational skills and competencies rather than for their knowledge of HACCP. However, the lack of specific knowledge of the field and HACCP rules/regulations could lead to fundamental shortcomings within HACCP teams. The following section explains the Wallace et al. (2005) HACCP knowledge questionnaire, i.e. a test to find out what knowledge about HACCP potential team members have. The experimental method used to record the deliberative and decision-making process of HACCP teams and the experiment itself are then illustrated. Finally, the results of the experiment are presented.
Specific elements on group decision-making	High, low and mean levels of team cognitive ability have been positively correlated with measures of team performance, however, mean cognitive ability was found to be a weaker predictor of team performance in real organisational settings than in laboratory studies. Potential reasons for performance differences within a team include: • Inappropriate combination of team roles or personnel in key team roles with inappropriate personal team role characteristics • Team decisions affected by group polarisation or groupthink. • Individual reluctance to offer suggestions due to lack of confidence in own knowledge/abilities.
Lessons learnt or recommendations	The common belief is that a multidisciplinary team provides a better HACCP solution than what could be expected from individuals working alone. In this experiment, however, it turned out that within the team, a levelling of knowledge takes place, as the knowledge of the individual members meets at a 'midpoint' that becomes the knowledge of the team. "It is important for food companies to understand the levels of HACCP knowledge that different individuals possess before the selection of team members. This would either allow the balancing of skills within the HACCP team or the assigning of a specialist 'HACCP Process Facilitator role,' an individual or individuals who are known to have an excellent knowledge of HACCP principle application and are given the task of keeping the HACCP process on track and correct, thus allowing other team members to concentrate on the discipline specialism." The results of this study show that it would be advantageous for food companies to ensure that there are enough high-performing individuals within HACCP teams to "balance out" lower-performing individuals, rather than automatically expecting team performance to be better than individual performance.

Factsheet 4

Name of the publication	Mondou M, Maguire S, Rahman HT, Pain GC and Hickey GM, 2022. Policy forums and learning in fields underpinned by regulatory science. Environmental Science & Policy, 137, pp.349-358.
Objective of the document	This paper explores factors linked to individuals and forum dynamics that encourage policy learning in fields underpinned by regulatory science.
Territorial coverage	The geographical area is not defined
Methodology	Literature review

Themes	How to integrate new ways of working European approaches to regulatory science
Main findings	This article has five sections. The first presents the conceptual framework; the second describes the empirical context within the data collected. The empirical context of the research is that of ecotoxicology, i.e. a regulatory science underlying chemical management policies. The main objectives of ecotoxicology are to identify and assess threats to wildlife from hazardous chemicals in the environment and to suggest measures to reduce these threats. The third section introduces the research method which is based on a survey of ecotoxicology professionals who had attended at least one event organised by SETAC (Society of Environmental Toxicology and Chemistry), to assess their self-reported learning experiences at this policy forum. The fourth section presents and discusses results, assessing learning outcomes reported by participants in the policy forum studied as well as factors affecting them. Finally, the conclusion discusses the implications of the study, identifying lessons for forum design to support policy learning in fields underpinned by regulatory science.
Specific elements on group decision-making	Two specific points about forums: • Open, balanced and professional standards-based forums do not necessarily produce efficient policy learning due to the scepticism of forum participants. • The longevity of forum participation facilitates learning, while the intensity of participation may hinder it.
Lessons learnt or recommendations	The steps that could be taken to promote learning in regulatory science through novel forum design principles are: • incentivising long-term forum participation, perhaps by focusing the core activities of the forum around the problem-solving mission, and segmenting networking functions at different events and venues may help to maximise learning benefits. • maximise activities that expose forum participants to novel academic research in settings where professionals are less concerned about their stakeholder affiliation and reputation during discussions. Different collaborations within the forums have different impacts: - Collaboration with academics raised the likelihood of self-reported learning and lowered the likelihood of non-learning and of not changing one's opinion. Collaborating with academics lowered the likelihood of having and keeping extreme opinions. However, collaboration with academics also raised the likelihood that respondents 'hardened' their opinion. Hardening is considered an indication of motivated scepticism, that is, the tendency to retain and use only the information that confirms one's prior opinions. -Collaboration with industry and governments shows a dominant pattern of scepticism. Specifically, more frequent collaboration with industry and governments raises the likelihood of non-learning and significantly lowers the likelihood of softening one's position. -Collaboration with NGOs was found to lower the likelihood of self-reported non-learning in general and significantly so with regards to opinion hardening.

Factsheet 5

Name of the publication	Tindale RS, Kameda T and Hinsz VB, 2003. Group decision making. Sage handbook of social psychology, pp.381-403.
Objective of the document	This chapter highlights some of what is currently known about how groups reach a consensus on decision-making/problem-solving tasks, and how

	such consensus processes affect the quality or accuracy of the final group response.
Territorial coverage	The geographical area is not defined
Methodology	Literature review
Themes	How to integrate new ways of working European approaches to regulatory science
Main findings	The chapter begins by discussing the status held by groups, i.e. how truly important decisions are historically entrusted to groups. Then it highlights some of what is currently known about how groups reach a consensus on decision-making/problem-solving tasks, and how much consensus processes affect the quality or accuracy of the final group response. This work stemmed, in part, from the political and economic work on "social choice theory", a model in which information processing at the group level is "the degree to which information, ideas, or cognitive processes are shared or are being shared among the group members …" and the different ways of sharing can change their decisions: the degree to which preferences and/or information were "socially shared" was a key aspect to understanding group decision processes and outcomes. The authors attempt to show that much of the literature about 'sharedness' (i.e. the degree to which individuals hold something in common with others) can be understood at one of three levels: preferences, cognitions, and metacognitions. At each level, the degree of sharedness is important for understanding both how groups reach a consensus and the decision alternative or judgment position on which the group finally decides. Among the approaches on how preferences change over time and are combined to yield a final group consensus, the most comprehensive conceptual system for describing group aggregation processes is 'Davis' Social Decision Scheme' (SDS) theory. SDS theory assumes that small group interaction can be seen essentially as a combinatorial process, in which preferences for decision alternatives across group members are combined in such a way as to allow the group to reach a consensus on a single group choice. SDS theory allows a systematic investigation into which aggregation model best describes the actual consensus process in a given setting. The text goes on to illustrate the 'Social Judgment Scheme (SJS)', a model based on position discrepancies (distance among preferences) along the response continuum among the members of a group. The SJS model essentially assumes a dominant role of central members in guiding consensus. The paper then describes two macro phenomena that are important for the group preference process: group polarisation and the manipulability of group decisions. The authors then discuss attempts to understand group decision-making processes, not through preference analysis, but through understanding the group at the cognitive level: in particular, the 'Persuasive Arguments Theory'. The paradigm called the 'hidden profile technique', which studies the effects of shared and unshared information on group decision-making, is then illustrated and the basic finding has been called the 'common knowledge effect' (which is then explained in the following section). The paper goes on to illustrate how research has focused on the status or power of group members according to the degree to which they share knowledge with other members. In connection with this, a model designed to represent the degree of 'cognitive centrality' of a group member is presented. The next section deals with socially shared metacognition and explores in particular the 'Nelson model'. This model argues that there are two

	important processes involved in metacognition: 1) the monitoring process, which reflects the information gained about activities at the object level; and 2) the control process, which shows what the respondent thinks about the decision-making situation. One of the final points of the paper deals with the group's shared memory, in particular with 'transactive memory', i.e. how group members use and rely on each other to remember the material. The last topic covered is social identity theory and, in particular, 'categorisation theory'.
Specific elements on group decision-making	"The degree of social-sharedness in members' preferences at the onset of interaction plays a critical role in determining final consensus outcomes." Group polarisation - the risky alternative that is most dominant at the individual level becomes more dominant at the group level, whereas the other weaker alternatives become even weaker at the group level. Furthermore, if there is no external evidence proving why biased preferences are wrong, and/or if members lack logical or statistical backgrounds to understand those corrective arguments, then consensual processes would essentially be determined by shared preferences at the outset of interaction. Hence, the quality of group decisions should depend on what kinds of preferences are shared at the outset in a given group stochastically. Manipulability of group decisions – Condorcet's voting paradox; the chairperson who can choose which voting order to take can potentially manipulate the group decision outcome to personal advantage. Also, continuous group decisions can be guided toward a particular individual's advantage through procedural manipulation tactically utilising social sharedness. Persuasive Arguments Theory - if there were persuasive arguments favouring positions on one end of the response continuum, then the sample of arguments would favour that end and would lead group members to move in that direction, producing group polarisation. Common knowledge effect - shared information dominates discussion and determines decisions because is more likely to be recalled than unshared information at the group level. Although very robust and often replicated, the common knowledge effect can be attenuated by some procedural mechanisms; for example, extending the discussion time of groups should help ensure that unshared information gets brought up during the discussion. However, the opposite seems to happen when time pressures are put on the group. Measure of cognitive centrality - defines members in terms of the degree of centrality in the socio-cognitive network. The greater the degree of overlap between the information held by a given member and the information held by other members on average, the greater the degree of centrality for that member. Metacognition in groups - Metacognition in decision-making groups can be considered as how group members think about the ways they process and share knowledge in an attempt to reach group decisions. The metacognition that group members have for their groups has the potential to influence the decision-making processes and outcomes of groups. "Group performance depends on the group size, the competence of members, correlation among members' judgments, the constraints on member interaction, and the group's decision rule." Categorisation theory - members hold a prototype of the typical group member and attempt to behave by this prototype. In addition, group identity allows one to differentiate oneself and one's group from other groups, much like any form of categorisation both define what an item is and what it is not. This tends to lead to prototypes that help the differentiation process.

Lessons learnt or recommendations	Recent research has demonstrated that shared information dominates discussion and determines decisions. Being the central person in the group allows the person to have a greater degree of influence on the group, even when his/her preferences are in a minority position. "Research on the common knowledge effect tends to show that shared information plays a central role in group decision-making. In addition, it shows that shared information and shared preferences tend to correspond with each other." Another research shows that minorities advocating correct positions can override incorrect majorities by using shared knowledge structures: whenever a "shared task representation" exists, when the group process, it will tend to take on an asymmetric structure favouring the decision alternative that is consistent with the representation. If no shared task representation exists, or if multiple conflicting representations are present, then groups will tend to follow a symmetric majority/plurality type process. It has been shown that giving groups a shared norm or processing goal oriented toward "critical thinking", rather than "consensus building" leads to a reduction of the common knowledge effect. Thus, shared norms can moderate the effects of shared information. Moreover, allowing group members to know which other members are "experts" in particular areas or what information other members have also attenuated the common knowledge effect. "It is important that the group members share accurate mental models. If group members share mental models of the way their group should reach decisions, there should be less disagreement among the members about the way to reach a decision. The group should be more efficient and effective in reaching a decision and the group members will believe that their group was effective and efficient in its use of time. Consequently, the members will be more satisfied with the decision-making process and be more willing to participate in the group in the future."

Factsheet 6

Name of the publication	Da Vinha L, 2013. Group-sharing, not Group-think: Understanding Foreign Policy Decision-Making through a Social Sharedness Approach. Perspectivas-Journal of Political Science, 11, pp.31-53.
Objective of the document	This paper seeks to demystify the groupthink phenomenon and present an alternative assessment of group dynamics in foreign policy decision-making. It presents a conceptual framework based on social sharing mechanisms for comprehending how groups develop the problem representations that influence their foreign policy decisions, it seeks to highlight the positive contributions of group dynamics in effective decision-making.
Territorial coverage	The geographical area is not defined
Methodology	Literature review
Themes	How to integrate new ways of working 'Best' practices in other institutions for decision-making
Main findings	The article begins by presenting the best-known academic research on groupthink (which has influenced opinion on it over the years), namely Janis's groupthink theory. Then, the research moves (while conceding to the possible limitations involved in group decision-making) on the recent developments in social psychology which provide a more comprehensive approach to understanding the complexity involved in group dynamics, analysing above

all the importance attributed to socially shared meaning - i.e., social cognition.
Five models are then exposed to understand how sharing contributes to information processing in a group. The five models are: 1) shared preferences; 2) shared information; 3) shared identity; 4) shared metacognition; and 5) shared task representations.
The research then focuses on cognitive approaches to representations of problems, which are usually presented in the form of aggregation, i.e. by measuring the knowledge of individual group members and averaging the results of the whole group, rather than through a convergence-based approach that argues how the relationships established between different group members are essential to the outcome.

Specific elements on group decision-making

According to Janis, groupthink results from extreme forms of group cohesiveness which have a detrimental effect on the decision-making process. Particularly significant is the role of stress. Thus, highly demanding situations place great anxiety on individual group members who consequently tend to find comfort and assurance through affiliation with the other members of the group. It is precisely the severe decisional stress that decision-makers occasionally encounter that leads them to reinforce their cohesion within the group.
The groupthink type of conformity tends to increase as group cohesiveness increases. Groupthink involves nondeliberate suppression of critical thoughts as a result of the internalisation of the group's norms
Janis (1983) defined a host of antecedent conditions – i.e., contextual causes – facilitating groupthink, which are divided into three individual categories: 1) high level of group cohesiveness; 2) structural faults of the organisation; and 3) provocative situational context.
Janis identified eight main symptoms of groupthink, divided into three main types, which are self-reinforcing:

1. illusion of invulnerability shared by group members which encourages high degrees of risk-taking.
2. unwavering belief in the group's moral righteousness, this can lead to a disregard for any ethical or moral consequences related to their decision;
3. group's effort to rationalise the existence or surfacing of warnings or dissonant information, this allows the group to discount these dissonances and avoid revaluating their existing assumptions and beliefs;
4. stereotyping, the group develops stereotyped images of its adversaries and does not consider all the complex dimensions inherent in the adversaries' actions and decisions;
5. self-censorship, which constrains individual members from deviating from an apparent group consensus;
6. unanimity;
7. pressure, it seeks to deny any dissent in the group, therefore reinforcing the concurrence-seeking norm;
8. mindguards, whose sense of duty is to protect the group from unfavourable and conflicting information and views that might shatter the group's self-assurance about the effectiveness and morality of its decisions.

Janis defined a host of antecedent conditions facilitating groupthink divided into three categories:

a) high level of group cohesiveness;
b) structural faults of the organisation; and
c) provocative situational context.

Janis identified seven consequences (or defects) derived from groupthink:

A. incomplete survey of alternative policy options;
B. inadequate assessment of the objectives to be achieved, as well as the values associated with those objectives;

C. failure to examine the risks of the preferred choice;
D. inability to reconsider initially rejected alternatives;
E. poor information search;
F. divergent information and evidence are repudiated;
G. lack of contingency planning.

Janis's assumptions have been much criticised mainly for the lack of evidence and references that they were not failures. Janis himself states that certain group dynamics contribute to more efficient decision-making.

Social cognition - it derives from social interactions that 'generate shared perceptions, behaviours, and products, including memories, norms, belief systems, and interpretations of shared events and activities'. Acknowledging cognition as a fundamentally social activity has challenged the conventional wisdom that cognition is exclusively an individual act and placed the group as the primary unit of analysis.

The basic assumption is that 'things that are shared to a greater degree within groups will have a greater influence on the relevant group outcomes/responses than those things shared to a lesser extent:

1. Shared preferences - members which share a particular preference can impose that preference on the group.
2. Shared information - in group discussions, shared information is much more likely to be recalled than unshared information. An individual's status or power in the group can be determined by the amount of information the person shares with the other members.
3. Shared identity - by categorising oneself as a member of a group, an individual implicitly accepts sharing a set of characteristics and behaviours that distinguishes his group from others.
4. Shared metacognition - the knowledge group members have of the extent of sharedness. The possibility of group members acting as external storage locations creates a knowledge-storage system that exceeds the individual capacities of the sum of the individual group members.
5. Shared task representations – a conceptual system of ideas that allows them to realise when a proposed solution is correct within that system. Shared task representations in a group allow for alternatives consistent with that representation to be defended more effortlessly and therefore more prone to prevail as the group's ultimate collective choice.

Conversion process - shared cognition always develops from individual cognition. The conversion process follows a three-phase process. The initial phase is the orientation stage in which group members collect new information and gather unshared information about the group through observation, experimentation, and investigation. Next, the differentiation phase sorts, consolidates, arranges, and stores the information previously collected, producing a transactive memory system that can be accessed when necessary. The final stage is the integration phase, in which the similarities, differences, and irrationalities are reconciled and the individual's internal representations of the world change from an individual perspective to a team perspective.

Lessons learnt or recommendations

The possibility of pooling information and experience among group members can improve decision-making, for group 'discussion can perform a corrective function when members individually have incomplete and biased information'.

Group members must achieve an understanding of how the other members of the group interpret the information exchanged and what meaning they attribute to the differences in interpretation. Each individual member needs to acknowledge the diverse perspectives about the information collected held by each other member. After that, similarities, differences, and irrationalities are reconciled and the individual's internal representations of the world change from an individual perspective to a team perspective. This

stage is concluded when the group achieves a level of integration which allows it to perform its task successfully. The level of integration affects group performance. For example, when integration is not sufficiently accomplished the group may not perform up to their optimal capability due to the lack of information and knowledge between members. In contrast, too much integration may hinder decision-making by facilitating group thinking.

Factsheet 7

Name of the publication	Klintman M and Kronsell A, 2010. Challenges to legitimacy in food safety governance? The case of the European Food Safety Authority (EFSA). European Integration, 32(3), pp.309-327.
Objective of the document	This paper aims to find patterns for how democratic processes are combined in European food safety governance. The attention of the paper is on one specific attempt at developing new governance in the food safety domain, in particular, inside EFSA. The central questions of this article are: - Using the case of EFSA, what forms of participation do we see in the new food safety governance? - How are these forms of participation related to the goal of increasing the legitimacy (and public trust) of European food safety governance?
Territorial coverage	EFSA
Methodology	Case study
Themes	European approaches in regulatory science 'Best' practices in other institutions for decision-making
Main findings	The article begins with a brief introduction to EFSA, followed by a brief description of the theoretical framework, which addresses and describes forms of participatory practices that give more legitimacy to the policy input. A distinction is made between integrative and aggregative processes. Based on the theoretical distinctions presented in the framework, the analysis is structured around three themes: 1. EFSA's objectives (Increasing food safety in the European Union; Public confidence in European food safety; European harmonisation of food regulation and trade); 2. how EFSA functions (hybrid between two integrative ideals: on the one hand, deliberative elitism, through an exclusive and communicative rationality and, on the other hand, a deliberative and participative perspective, through an inclusive and communicative rationality); and 3. authority, knowledge, and formal communication within EFSA.
Specific elements on group decision-making	The studies on aggregative and integrative political processes assume that reasoned rationality would be practiced by elites, albeit from various fields. The precondition for integrative politics is that the 'traditional' logic of aggregation (i.e. the consideration of elite thinking only) be questioned at the outset. Aggregative governance processes include various actors and take place through bargaining among what are assumed to be self-interested, rational actors. In the bargaining process, different interests are aggregated into collective choices. The actors — individuals or groups — are defined by self-interest around which they bargain to reach compromises. In integrative governance processes, conflicts can be overcome through deliberation towards shared preferences; the common good is reached through deliberation among reasoning actors in a context of shared values.

	Aggregative and integrative political processes are both participatory governance forms that can be exclusive or inclusive. Fixed preferences are typically associated with aggregative processes, whereas flexible viewpoints are said to belong to integrative political processes. It would be argued that EFSA has a hybrid between two integrative ideals: on the one hand, deliberative elitism, through an exclusive, communicative rationality, to achieve food safety (output legitimacy), in turn leading to input legitimacy, and, on the other hand, a deliberative participatory perspective, through an inclusive, communicative rationality, with input from people in various interest groups and with a broad range of experiences. EFSA is in part based on the inclusive, integrative perspective, manifest in the invitation of many groups to participate. Still, this participation takes place at different levels, or rather within different circles.
Lessons learnt or recommendations	EFSA is an example of the difficulty the Commission faces in moving from old to new forms of governance. This difficulty is reflected in the mix of aggregative (old) and integrative (new) logics within the agency. This difficulty, in turn, may be a challenge to the goal of greater EU legitimacy, at least as far as food safety governance is concerned. Looking at EFSA's activities, it is possible to distinguish between two types of dependence that need to be circumvented. The first type of dependence that EFSA tries to avoid concerns associations with the interest of one nation or organisation. Through the above-mentioned organisational arrangements and processes, EFSA explicitly tries to reduce the risk of such dependence. The other type concerns the value-based selection processes that are necessary factors entailing that science is never independent and value-free in any absolute sense. "On the one hand, EFSA seems to aspire to integrative policy processes, reflected in its emphasis on shared preferences for food safety and public trust. On the other hand, it is fair to say that EFSA's logic, means, and strategies are based on a vision of aggregative policy as a 'natural state'. This natural state should be stifled or balanced through the prevention of members' bargaining between fixed and different interests and strategies. This is different from a fully integrative logic, in which deliberation and open learning between actors and experiences is assumed from the outset."

Factsheet 8

Name of the publication	Apostolopoulos C, Halikias G, Maroukian K and Tsaramirsis G, 2016. Facilitating organisational decision making: a change risk assessment model case study. Journal of Modelling in Management, 11(2), pp.694-721.
Objective of the document	This paper aims to take the challenge to propose a novel modelling approach named Change Risk Assessment Model (CRAM), which aim is to contribute significantly to the missing formality of business models, especially in the change risk assessment area and decision-making.
Territorial coverage	Although the case study addressed in the paper specifically refers to a company largely located in India, the research can be universally extended without a specific geographical area of reference.
Methodology	Case study
Themes	How to integrate new ways of working 'Best' practices in other institutions for decision-making
Main findings	The article begins with a section presenting the results of the literature in terms of AHP (Analytic Hierarchy Process) modelling used in various fields. AHP is a well-established and structured multi-criteria hierarchical technique for making complex decisions, which is achieved by constructing a matrix showing the relative importance of each criterion concerning the others.

	The following section provides an overview of the interrelated processes of the three CRAMs. CRAM is a methodology to enable the effective assessment of risks associated with organisational changes, the main research idea of which arose from the fact that project changes entail risks that must be assessed and controlled. The aim is to propose an integration of change management within contemporary project management frameworks, together with a risk assessment mechanism in the form of a hierarchical model. The result is a new model approach for enterprise change management risk assessment. It can be easily integrated with contemporary project management frameworks, as the factors are widely applicable to the broader landscape of business environments. CRAM is divided into three interrelated processes that construct its main elements: • Risk Identification - identify the threats and opportunities which may affect the projects' objectives; • Risk Assessment - Risk Estimation and Evaluation phases of change risks (develop a risk mitigation plan and take necessary preventive actions); • Risk Monitoring & Control - identify, analyse, plan and track new risks, constant and periodic testing and review of initially identified risks, monitor and control existing or residual risks. The paper goes on to present the methodology used to assess change risks. Furthermore, the case study "RingTokk Systems" is presented in this section. RingTokk is a telecommunication company that seeks, through state-of-the-art methods, to come up with creative softphone solutions. The company had serious problems entering the market and beating the competition: the company's mission and vision were not clear enough and the company had problems, especially in operations and project planning. For this company, the implementation of the CRAM method was tested, to identify and control known risks and to identify the root cause at an early stage if a risk materialises. The paper then analyses and discusses the results of the CRAM, in which leadership, culture, and communication were found to be the most important risk factors for change.
Specific elements on group decision-making	The three most important risk factors that need to be controlled and perhaps modified for a project to be successful are: • knowledge sharing - there is a need for a culture of knowledge sharing through the use of documents, models, or, in general, shared information systems. The language must be comprehensible to all stakeholders and convey the communicator's meaning as accurately as possible; • involvement - as organisations become larger and more complex, the need for a structured project management methodology emerges; • conflict management - conflicts should be resolved early in the project process because they strongly affect the collaborative work between team members and can lead to uncontrolled situations. The project management team in turn has different characteristics, such as culture, experience, and management level, which must be combined to ensure that the project results meet the customer's requirements and expectations. The most effective project management processes are those whose team members facilitate innovation and learning as much as possible. If the team works in a spirit of empowerment, this can be of great help in fostering greater motivation, thus leading to project success.
Lessons learnt or recommendations	Leadership is the key factor for successful project management. One of the roles that the project manager has to play is that of a leader. The project manager acts as the 'glue' between the project and the team members, ensuring that the stakeholders remain focused on the project objectives. In change management, the project manager acting as a leader must

ensure that team members understand and respond to change management processes.
Organisational culture is an integral part of the functioning of the organisation. If the culture is strong, values are shared and everyone is aligned. This provides a shared system of meanings, which forms the basis of formal communication and understanding. In other not-so-positive cases, managers can influence the behaviour of those in the organisation through the right tools that bridge the gap between what is formally announced and what happens.
Especially in project management, problems may occur because the cultures of the stakeholders differ in various ways. The project culture must consist of a shared organisational culture and the professional culture of the individuals. Sometimes, to change the organisational culture, it is necessary to reconstruct the existing cultural assumptions in the organisational structure.

Factsheet 9

Name of the publication	Gualotuña Parra JA, Tarquis AM, Grau Olivé JB, Colombo Speroni F and Saa-Requejo A, 2021. An analytical approach to assess the influence of expert panel answer on decision making: The case of sustainable land use in ribadavia banda norte, salta (Argentina). Sustainability, 13(12), p.6705.
Objective of the document	In this study, the responses provided by an expert panel in the context of future environmental management of an agroforestry territory in the Salta Province (Argentina) are evaluated. The researchers evaluated five productive techniques' influence on criteria related to environmental, social, and economic consequences. Then, the influence of these results in a multicriteria decision about the productive use of land is evaluated.
Territorial coverage	Agroforestry territory in the Salta Province (Argentina).
Methodology	Case study
Themes	How to integrate new ways of working
Main findings	The paper begins with the introduction of the case study, which focuses on an area in Argentina where extensive extractive agricultural production is carried out, causing problems of poverty, inequality, unmet basic needs, pollution, etc. The study attempts to determine the possibility of sustainable land use by considering five production alternatives. The research was carried out through a questionnaire consisting of 31 questions posed to a group of experts selected in such a way that there were three discussion groups: stakeholders, experts, and site facilitators or trainers. Dendrograms are constructed to group experts according to their opinions - by grouping similar opinions to then compare the different categories. For this study, a discrete MCDA (Multi-Criteria Decision Analysis) was performed using a classical method to rank and position alternatives, in this case, techniques based on weighting and expert opinion. The special feature is that, if the dendrogram reveals disagreements between experts, alternative matrices have been produced with the opinions of each group of experts in disagreement. The method used allows for a second stage of consensus analysis and its objectification. However, it does not allow for comparison between experts based on the studies supporting each opinion. The proposed analysis allows to quantify the agreement between experts and group them according to their opinions. This procedure allows to

	address discrepancies instead of hiding them behind an average or forced consensus.
Specific elements on group decision-making	
Lessons learnt or recommendations	Policymakers and managers can use participatory analysis to assess stakeholders' and experts' knowledge, interests, and positions regarding production techniques. This analysis allows them to interact more effectively with key agents and increase support for a given policy or program. When this analysis is conducted before implementing a policy or program, policy makers and managers can identify and act to prevent potential misunderstandings and/or opposition to the policy or program. A study conducted on the analysis of uncertainty and prioritisation of changes in landscape sensitivity highlighted the need for both individual and collective expert analysis.

Factsheet 10

Name of the publication	Wegerif R, Fujita T, Doney J, Linares JP, Richards A and Van Rhyn C, 2017. Developing and trialing a measure of group thinking. Learning and Instruction, 48, pp.40-50.
Objective of the document	This paper offers a critical review of the issue of assessing the quality of group thinking. Moreover, it describes the development of a Group Thinking Measure that fills a gap revealed by the literature. The paper also illustrates the use of this measure, in combination with interpretative discourse analysis, as a way of distinguishing those behaviours that add value to group thinking from those behaviours that detract value.
Territorial coverage	This paper has no defined geographic characterisation because it investigates the concept of group thinking in general, trying to study children from different parts of the world (mainly the UK and South Africa) and different social conditions to generalise the main results.
Methodology	Experiment
Themes	How to integrate new ways of working
Main findings	The research begins by illustrating the experimental method used: to understand the improvement in group thinking, groups of children were asked to solve Raven's non-verbal reasoning tests (progressive matrix tests) before and after a 'Thinking Together' teaching intervention (a dialogue-based approach to the development of children's thinking and learning). Studies have been done in the UK, Mexico, and, more recently, China. In addition, in a series of studies in South Africa, Raven's tests were done to assess improvements in individuals' thinking after teaching the Thinking Together program. The paper then goes on to illustrate the theories used to ground models of effective groupthink. It then discusses the quality of group thinking.
Specific elements on group decision-making	Only three factors emerged as significant for good group work: 1. the presence of women; 2. 'social sensitivity' measured using the 'reading the mind in the eyes' (RME) test; and 3. the way the shifts were distributed in a speech, where groups with a more equal distribution did better. The significant impact of the presence of women in groups was largely explained by the fact that women showed greater social sensitivity leaving only two key factors for successful group thinking: social sensitivity and equal turn distribution.

	The Group Thinking Measure revealed general behaviours that characterised successful problem-solving: • Encouraging each other • Expressions of humility • Giving clear elaborate explanations • Equal participation with everyone in the group actively involved in each problem • Actively seeking agreement from others • Not moving on until it is clear that all in the group understand • Open questions • Warm positive affect with shared smiles and laughter • Willingness to express intuitions • Indications of mutual respect in tone and responses • Taking time over solving problems seen in accepting pauses and giving elaborated explanations when asked.
Lessons learnt or recommendations	Individual thinking is mediated by internalised social interaction. The researchers identified a new method, Group Thinking Measure, which, combined with qualitative video analysis, brought out how the non-verbal and social component is one of the main reasons for successful group thinking. It has been found that relaxation and laughter facilitate insight into creativity and that anxiety inhibits this phenomenon. The positive group atmosphere, with shared smiles and laughter, could create the sort of shared 'dialogic space' in which it is easier to look for creative solutions.

Factsheet 11

Name of the publication	Kuhn D, 2015. Thinking together and alone. Educational researcher, 44(1), pp.46-53.
Objective of the document	The article seeks to understand whether collaborative intellectual engagement applied to education can be good practice and whether it produces the same results in all contexts. The article then addresses other questions to bring evidence to support the practice of collaborative learning.
Territorial coverage	This paper focuses on the analysis of American school students in the primary and secondary education range.
Methodology	Experiment
Themes	How to integrate new ways of working
Main findings	The text begins by highlighting how peer collaboration has always been considered an enlightened educational practice. One might be led to believe that there is more evidence to support collaboration as a means of individual intellectual gain than there is. The text tries to show how cognitive collaboration with peers does not always produce identifiable benefits. The research then seeks to understand what conditions lead collaboration to produce desired results. To fully identify the conditions under which collaboration can be fruitful, the author of the text tries to understand the underlying mechanisms through studies comparing individuals working alone and/or evaluating the effects of group experience on subsequent individual competence. Next, the practice of problem-based learning (PBL) is illustrated, in which small groups of students are confronted with a problem with insufficient knowledge to solve it. The case illustrated deals with a pair of students who are given the task of observing and examining the position of the opposing

	pair to weaken them. The pair must also work to develop and sustain their position in the face of the opposing pair's parallel efforts to weaken it. These two goals can only be successfully achieved if participants recognise that the two different perspectives exist, reflect on and understand each of them, and strive to coordinate them to achieve the goals of the activity. In addition to being motivated to probe another mind, participants experience the control of others over their positions. Another experiment was then set out in which an attempt was made to distinguish the effects of the social component of the activity by observing a group in which the face-to-face component was removed. In this group, same-sided partners were eliminated, and each student individually interacted electronically with a set of opposing peers. A further attempt was to ask the students to argue their positions individually or in small groups and, in the case of the group, to reach an agreement. In the last part, the author questions whether intellectual collaboration is a means to an end (greater knowledge) or an end in itself.
Specific elements on group decision-making	Cognitive collaboration with peers does not always yield identifiable benefits, and whether it does or not appears to depend on who is learning what and under what conditions. Task conditions, as well as the task itself, tend to influence outcomes. Outcome differences were found as a function of the degree of structure imposed on the collaboration. Other conditions that may affect the outcomes of collaboration are participant characteristics, such as ability or age, and the relationship between the participants' ability levels. Collaboration may even lead to a decline in thinking quality. It has been noted due to the overconfidence that group interaction can produce. Without a comparison with how individuals work, the quality of the group's performance can mistakenly be attributed simply to the performance of its most skilled member. This more competent member achieves a correct solution and dominates but does not necessarily transmit this competence to the other members of the group. Higher levels of performance achieved by groups compared to individuals working alone can also be attributed simply to the division of labour within the group. The most productive collaborations were identified as those in which participants directly confront each other's thinking. Conflicting positions were identified as a productive factor, particularly when both were incorrect.
Lessons learnt or recommendations	Routine learning types are less likely to show a collaborative benefit than more conceptual learning methods. It seems that the component that makes PBL effective is the learning of new concepts in the context of a problem that requires their application, rather than social collaboration. But it is not, as one might think, the scale of the problem itself that provides benefits. What recognises the need for a better solution and, thus, a better unilateral approach is the presence of a unilateral goal on the part of the group that also highlights the possibility of its failure. Dialogues require attention to one another. Moreover, dialogues seem to involve the arguers more deeply and authentically, prompting them to bring what they already know into the exchange. The opinion of one interlocutor is scrutinised by the listener, which contributes to the recognition of one's position as contestable and therefore to be justified within a framework of alternatives and evidence. Argumentative discourse between proponents of opposing positions is the only context in which we can predict the cognitive benefits of student collaboration. Most productive collaborations have been identified as those in which participants directly engage in one another's thinking. The presence of conflicting positions was identified as a productive factor, notably when both are incorrect. Having different opinions brings to be motivated to probe another mind and discourse participants experience others' scrutiny

of their positions — scrutiny that is valuable precisely because it is so notoriously difficult to carry out one's thinking.
Intellectual collaboration does not come naturally; it is a skill developed through engagement, practice, and much trial and error.
We still do not know for sure if the practice of intellectual collaboration is used as a means to an end, because there are too many conditions that yield productive outcomes in need of further specification. But we are quite sure that intellectual collaboration could be an end itself: effective collaboration increasingly is a requirement in many contexts of adult life.

Factsheet 12

Name of the publication	Őnday Ő, 2016. Human resource theory: From Hawthorne experiments of Mayo to groupthink of Janis. Global Journal of Human Resource Management, 4(1), pp.95-110.
Objective of the document	This article focuses on organisation theory, initially by discussing the development of the organisation and organisational theory from its earliest stages, and then goes on to present the literature on the matter. The article then presents the basic principles of classical organisational theory one by one and highlights its relative strengths and weaknesses.
Territorial coverage	This paper has no defined geographical characterisation because it investigates the field of organisational science in general.
Methodology	Literature review
Themes	Group decision-making
Main findings	The paper begins with a brief description of what organisation theory is and what it is for. Organisational theory, however, is not a homogeneous science based on generally accepted principles, so various organisational theories have evolved or are evolving. These theories can be subdivided into 9 different 'schools' of thought, but this paper focuses on HR theory, which focused on the individual and the social relations between individuals, no longer seen as rational beings working to achieve the organisation's goals, but guided by particular feelings, sentiments, and interests. The main theorists and contributions of human resources theory are then presented: *The Several Best Ways* There is an informal structure in every organisation, coming from the unofficial contacts people in the organisation have with each other. This informal structure could be just as important as the formal one for predicting the outcome of decision-making processes – sometimes even more crucial. *Elton Mayo - Hawthorne Experiments* The group dynamics and social makeup of an organisation are extremely crucial forces either for or against higher productivity. This outcome causes the call for greater participation for the workers, greater trust and openness in the working environment, and greater attention to teams and groups in the workplace. *Mary Parker Follett - The Giving of Orders* If an order is given and it is demanded with unquestionable obedience it is not a positive business practice. By ordering someone to do something, a task will not necessarily be done satisfactorily. It is significant for supervisors to keep in mind that the employees they are giving orders to have set methods of doing tasks, therefore when they are

	told to complete a task in a manner that is out of the ordinary for them it is not easy for them to adapt and change. *Abraham Harold Maslow - A Theory of Human Motivation* The positive interaction of organisational culture and human resource management would result in self-esteem and self-actualisation. *McGregor - The Human Side of Enterprise* Employees can often achieve higher levels of productivity when they are treated as responsible contributors to an organisation rather than shirkers in need of prodding. Groupthink is also introduced through Janis's theory (the main points of which are given in the next section). The research continues by exposing the strengths and weaknesses of HR theory, i.e., strengths: (Shafritz, Ott, Jang, 2005). • It helped to address the issues of leadership, motivation, teamwork, work environment, effects of power and influence, and other related topics. • It broadened the definition and role of leadership and its effects. • It emphasised the importance of relationships, cohesion, and interdependence. • The theory focuses on the 'fit' between the individual and the organisation, the development of employees, and the benefits for both the organisation and the employees. • It is an optimistic theory, not focused on the conflict between individuals and organisations (as other theories often do). • The Hawthorne effect has helped shed light on employee productivity. • Weak points: • Perhaps places too much emphasis on consideration for the employee. • It considers productivity through the lens of employee behaviour, not the other way around. • Critics argue that some aspects, including Maslow's contributions, are not empirically supported and that it "oversimplifies the complex structure of human needs and motivations".
Specific elements on group decision-making	Groups often experienced groupthink (a mode of thinking that people engage in when they are deeply involved in a cohesive group) when the members striving for unanimity override their motivation to realistically appraise alternative courses of action. Groupthink exists when a group makes faulty decisions because group pressures lead to a deterioration of —mental efficiency, reality testing, and moral judgment. Groups affected by groupthink do not take into account alternatives and are driven to take irrational actions that dehumanise other groups. Group members try to minimis e conflict and reach a consensus decision without critical evaluation of alternative ideas or viewpoints, and by isolating themselves from outside influences. (Janis, 1972). Cohesiveness is an adequate but insufficient condition for groupthink to pervade a decision-making group. Janis postulated several secondary conditions necessary for groupthink to occur: • Insulation of the group; • Leader preference for a certain decision; • Lack of norms requiring methodical procedures; • Homogeneity of members' social backgrounds and ideologies.
Lessons learnt or recommendations	Classical approaches to organisations show that we live in a managerial organisational world. The managerial representation of the organisational world cannot be taken as the only representation because, relying on it alone, it is impossible to understand how organisation theory is part and parcel of a particular philosophical and historical context. Moreover, by

incessantly focusing on a one-sided image of instrumental rationality and control, one fails to understand the serious limitations, both in principle and in practice, of this image.

Factsheet 13

Name of the publication	Henriques G, 2020. Groupthink and the evolution of reason giving. Groupthink in Science: Greed, Pathological Altruism, Ideology, Competition, and Culture, pp.15-25.
Objective of the document	This chapter reviews the processes associated with groupthink and then lays out how a new unified theory of psychology can account for the various justification and social influence dynamics that drive groupthink.
Territorial coverage	James Madison University. Department of Graduate Psychology, Harrisonburg, United States. This paper has no defined geographical characterisation because it investigates the concept of groupthink in general.
Methodology	Literature review
Themes	Group decision-making
Main findings	The author brings up the matter of groupthink by presenting a chronicled episode, emphasising how a unified conceptual framework is lacking that bases and binds together the various lines of empirical work that currently define the field. The author, therefore, focuses on two key ideas that are part of the unified theory of psychology: the Justification Hypothesis - which provides an evolutionary account of human consciousness and culture and a clear framework for understanding why human beings are not endowed with abstract, analytical reasoning, but operate primarily as socially motivated 'reason givers' - and the Matrix of Influence - a map of the human relations system, in particular the social motivations and emotions that intuitively guide people in social relationships and exchanges. The paper goes on to try to use the theories presented to further clarify the phenomenon of groupthink.
Specific elements on group decision-making	One of the main characteristics of groupthink is that to demonstrate harmony and unity, people fail to consider alternative perspectives and ultimately engage in deeply problematic decision-making: The power of social influence in group contexts is enormously strong. Groupthink dynamics emerged, here listed following the classification provided by Janis (1982) Antecedent conditions: • Cohesion of the group (A) • Organisational structural faults (B1): lack of methodical procedure group norms (B1-3), homogeneity of the group members (B1-4) • Situational factors (B2): high stress from external threats (B2-2) • Observable consequences: • Symptoms of groupthink (C): Belief in group inherent morality (C-2), stereotypes of out-groups (C-4), the illusion of unanimity (C-6)
Lessons learnt or recommendations	Taken together, these models state very clearly that human reasoning is not a cold analytical process, designed to take in information and calculate pros and cons through a 'rational actor'. Human consciousness functions, first and foremost, as a social system of reason generation, which seeks a personally and publicly justifiable path to legitimise action. Having understood this, it is also easy to understand why group-thinking phenomena function in certain ways.

Factsheet 14

Name of the publication	O'Connell D, 2019. Reducing groupthink and improving decision-making in risk workshops. Governance Directions, 71(8), pp.449-456.
Objective of the document	This article outlines what groupthink is and how the Governance & Risk Team (GRT) at the Blue Mountains City Council (BMCC) used some simple techniques to mitigate it when conducting a workshop.
Territorial coverage	This paper has no defined geographical characterisation because it investigates the concept of groupthink in general.
Methodology	Case study
Themes	How to integrate new ways of working
Main findings	The article starts by explaining what Groupthink is, then it is shown a case study focused on reducing groupthink. The case study in question concerns the implementation by the Governance & Risk Team (GRT), of Blue Mountains City Council (BMCC), of the Enterprise Risk Management Framework. The GRT invented a simple experiment to reduce groupthink that would raise the level of engagement that was electronic distance voting equipment. In conducting the risk workshops, the GRT adopted some elements of Janis' groupthink framework: • selecting group members whose group cohesiveness encourages freer thinking; • splitting the group into independent sub-groups and run simultaneous workshops to assess the council's risk; • when making decisions about risks, members cannot express opinions verbally until after the votes are known; • that members' role in the workshop is to 'critically evaluate' the risks presented, they are therefore encouraged to air objections and doubts freely (post voting); • the Devil's Advocate position went to members of the GRT who facilitate the risk workshop. The results of the first workshop implemented in this way showed that if one must choose between one and five repetitively, the next choice will be based on past selections from that universe: whenever individuals engage in decision-making, they work to reduce the effort they need in making decisions. Hence, the interesting outcome was that while the results were independent of each member, they were not free from individuals' mistakes in decision-making, in this case, the influence of past choices on future choices.
Specific elements on group decision-making	In many groupthink cases, members disregard their personal beliefs to agree with the dominant view. Even when members are opposed to the decisions of the group, they tend to keep quiet, preferring to keep the peace out of fear of isolation rather than disrupting the uniformity of the crowd. Such behaviour results in sub-optimal choices and poor decision-making outcomes. Five factors lead to groupthink (Janis, 1971): 1. The group is highly cohesive 2. The group is insulated from outside information 3. The group is dominated by an assertive leader 4. The group experiences stress because of a critical incident 5. The group only considers a limited range of options These factors can produce an illusion of invulnerability, in which group members are overly self-assured in their decision-making skills. Members often suppress their opinions to prevent others from expressing ideas, not fitting the collective agreement.

Lessons learnt or recommendations	Groupthink is a psychological behaviour that impairs rational decision-making. Structuring a risk workshop correctly and introducing anonymous voting are methods of improving engagement. Mitigating groupthink will result in more accurate assessments of risk. An effective means of achieving this goal is to let the members make their selections by anonymously voting.

Factsheet 15

Name of the publication	Chwalisz C, 2020. Good practice principles for deliberative processes for public decision making. in Innovative Citizen Participation and New Democratic Institutions: Catching the Deliberative Wave, OECD Publishing, Paris.
Objective of the document	This chapter explains the methodology and sets out the good practice principles that may be of useful guidance to policymakers seeking to develop and implement representative deliberative processes.
Territorial coverage	This chapter has no defined geographical characterisation.
Methodology	Literature review
Themes	How to integrate new ways of working Citizens' involvement in the decision-making process
Main findings	This article discusses how the OECD has gathered much evidence on how representative deliberative processes work in different countries. Although there is a wide variety of models, analysis of the data collected reveals several common principles and good practices that may be useful to guide policymakers seeking to develop and implement such processes. The development of the principles of good practice was based on the analysis of evidence gathered by the OECD in its work on deliberative processes, and with the aim of supporting the implementation of provisions 8 and 9 of the Recommendation on Open Government. Furthermore, the OECD evaluated the existing literature, where several organisations and academics have already defined some principles for deliberative processes.
Specific elements on group decision-making	Good practice principles for deliberative processes public decision-making: 1. Purpose - the objective should be outlined as a clear task and is linked to a defined public problem. 2. Accountability - the commissioning public authority should publicly commit to responding to or acting on participants' recommendations promptly. 3. Transparency 4. Representativeness - the participants should be a microcosm of the general public. This is achieved through random sampling. 5. Inclusiveness - considering how to involve under-represented groups. 6. Information - participants should have access to a wide range of evidence promptly accessible evidence and expertise. 7. Group deliberation - participants should be able to find common ground to underpin their collective recommendations to the public authority. 8. Time - deliberation requires adequate time for participants to learn, weigh the evidence, and develop informed recommendations. 9. Integrity - the process should be run by an arm's length coordinating team, different from the commissioning public authority. 10. Privacy

	11. Evaluation - there should be an anonymous evaluation by the participants to assess the process based on objective criteria
Lessons learnt or recommendations	Lessons learnt: The OECD Recommendation on Open Government (2017) states, about citizen participation in government, that adherents should: "8. Ensure equal and fair opportunities for all stakeholders to be informed and consulted and actively involve them at all stages of the policy cycle [...]"; and "9. Promote innovative ways to effectively engage with stakeholders to gather ideas and co-create solutions". Even if the results are independent of each member, they are not free from individuals' foibles in decision-making, in this case, the influence of past choices on future choices. Representative deliberative processes are one of the most innovative methods of fostering citizen participation in government. Good practice principles are intended to be the starting point for public decision-makers wishing to commission deliberative processes, and for practitioners wishing to design and organise them. It is important to grant all stakeholders equal and fair opportunities, access to information and right to consultation, actively engage them in all phases of the policy cycle, as well as promoting innovative ways to effectively source ideas and co-create solutions with stakeholders.

Factsheet 16

Name of the publication	Hokanson KE, Ellstrand N and Raybould A, 2018. The integration of science and policy in regulatory decision-making: Observations on scientific expert panels deliberating GM crops in centers of diversity. Frontiers in Plant Science, 9, p.1157.
Objective of the document	This paper shares a perspective on the use of panels of experts with specialised knowledge and experience based on panels convened to inform the regulatory strategy for three separate projects developing Genetically Modified (GM) crops for cultivation in Africa: a nutritionally enhanced sorghum, an insect-resistant cowpea, and a virus-resistant cassava.
Territorial coverage	The research was based on GM cultures in various parts of Sub-Saharan Africa, but the main results can be applied in every context.
Methodology	Case study
Themes	How to integrate new ways of working Health, environment, food, sustainability Science for policy
Main findings	The case studies used in this article to analyse the perspective on the use of scientific panels, based on the panels convened to inform the regulatory strategy concern three separate projects to develop GM crops for cultivation in Africa: a nutritionally improved sorghum, an insect-resistant cowpea, and a virus-resistant cassava. In these case studies, expert panels were convened specifically to consider the risks associated with gene flow from a genetically modified (GM) crop to its naturally occurring 'wild' relatives. The experts used problem formulation to identify effects that regulators might consider harmful ('harms') and formulate what plausible scenarios might lead to them. The different groups demonstrate the challenge of integrating scientific and non-scientific policy-related information into the decision-making process and the need for a clear policy to avoid an unnecessary search for more and more scientific information.

	Problem formulation for risk assessment of the use of GM crops can be seen as a method for formulating and proposing hypothesis tests that are relevant for decision-making regarding particular products. After problem formulation, risks can be identified by testing the risk hypotheses with existing information. First, the groups decided which effects of gene flow from a crop to a wild relative would be considered environmental 'damage' by a regulator. The determination of which harms are to be considered in regulatory risk assessment is a matter of policy and is usually derived from the protection goals, i.e. the overall policy objectives that the regulation aims to achieve. Since the panels operate independently of any specific policy orientation, the determination of harm was based on precedents of existing risk assessments and assumptions of change that could be considered harmful to the environment. The definition of harm has allowed expert groups to focus on the elaboration of the steps that would have to occur for harm to occur; the series of steps leading to a particularly damaging effect is called the 'conceptual model' or 'damage pathway'.
Specific elements on group decision-making	Expert groups have proven to be an effective means for experts from different disciplines, sometimes disagreeing on their initial concepts of risk, to work collectively to organise knowledge into effective risk assessments. It was found that panel discussions and the use of problem formulation are firstly excellent forums for organising existing knowledge to predict the likelihood of harmful effects; and secondly, useful for identifying scientific uncertainty associated with the predictions, and studies that could be conducted to reduce that uncertainty. The most notable observation on these expert panels is the need to discern scientific and non-scientific information.
Lessons learnt or recommendations	Lessons learnt: Panels of experts with specialised knowledge and experience are valuable for gathering and organising existing information so that it can be considered in risk assessments of GM crops, and problem formulation is a highly effective tool to facilitate this. These panel discussions demonstrated that, while scientific expertise is essential to provide the knowledge necessary for making good decisions, science cannot operate in a policy vacuum. Without a policy, science may produce data that are unnecessary for risk assessment and data that are not very interesting for basic research. Scientific experts must not be in charge of deciding on politics-related aspects, such as which, harms should be considered and what information should be considered essential for a regulatory authority to decide the acceptable level of risk. Regulators to whom the remit for decision-making does fall, i.e., those responsible to use the scientific knowledge gathered for the risk assessment to decide the acceptable level of risk, should be aware that scientific experts can inadvertently drive regulatory policy toward the acquisition of new or 'nice-to-know' data through an emphasis on scientific uncertainty.

Factsheet 17

Name of the publication	Syberg K and Hansen SF, 2016. Environmental risk assessment of chemicals and nanomaterials—The best foundation for regulatory decision-making?. Science of the Total Environment, 541, pp.784-794.
Objective of the document	The text discusses the true extent of environmental risk assessment (ERA) as a more objective and reliable tool to inform risk management.

Territorial coverage	There is no specific territorial coverage.
Methodology	Case study
Themes	European approaches in regulatory science How to integrate new ways of working Health, environment, food, sustainability Science for policy
Main findings	The article begins by pointing out that environmental risk assessment (ERA) is often advocated as the best decision-making framework to ensure regulation and risk management (particularly with respect to risk related to chemicals and nanomaterials). Over time, however, ERA has come under increasing criticism for failing to provide the input that risk managers need. One of the main limitations of environmental risk assessment seems to be the fact that risks can only really be assessed after the negative impact has been scientifically established. The author, therefore, questions whether an environmental risk assessment can provide sufficient knowledge to decision-makers to ensure 'evidence-based' regulation on the one hand, and to provide them with sufficient decision support to take precautionary action on the other. Two specific cases are used to try to understand this: the first case looks at one of the most comprehensive environmental risk assessments ever carried out in the EU, that of nonylphenol; while the second case examines engineered nanomaterials (ENM). These cases illustrate some of the challenges that environmental risk assessments face when it comes to identifying hazards, assessing dose-response (i.e. the required dose and frequency of administration of a substance in a population), and dealing with uncertainty and ignorance. To address these challenges, a review of the ERA is deemed necessary. The first challenge is hazard identification, which is difficult if the risk is to be quantified by standardised tests. In order to provide the best scientific basis for risk management, uncertainties should be highlighted rather than ignored. The second challenge is a dose-response assessment with respect to mixtures. Although the toxic potential of mixtures is recognised, risk assessments are mainly carried out only for individual chemicals, since the effects of mixtures are not quantified.
Specific elements on group decision-making	
Lessons learnt or recommendations	Lessons learnt: Since the quantification of risk is dominated by uncertainties, ERAs do not provide a transparent or objective foundation for decision-making. Therefore, they should not be considered as a stronghold for informing risk management. The ERA framework should rather be considered as a pragmatic set of tools that provides a systematic approach to determining risk rather than an evidence-based foundation for decision-making. One of the key limitations of the ERA seems to be that risks can only first be truly assessed after an adverse impact has been firmly established scientifically. The most important role of science is to address new questions and generate a novel understanding of complex issues. If such novel findings are not accounted for, ERAs may fail to provide the foundation for precautionary preventive action It is paramount that the foundation for management is presented in a very transparent manner, as this will ensure that it is clear if socio-economic interests are perceived as more important than a specified risk, or if uncertainties regarding the actual risk prevent a reliable assessment of risk.

Such transparency is needed if stakeholders and the public are to have the ability to judge if risk assessors live up to their political mandate.
Until the uncertainties within this field have been further limited it would be more feasible to let decision-making rely on alternative frameworks that also include other societal considerations as well as scientific evaluations that acknowledge uncertainty rather than ignore it and ethical discussions conducted in the light of the precautionary principle.
An important aspect of this approach is that stakeholders are involved in the initial stages of the assessment. It does provide for better decision support, as it delivers a more in-depth and transparent evaluation of a given risk as well as the pros and cons of various management options.

Factsheet 18

Name of the publication	Hatton RC, Gonzalez-Rothi RJ, Smith WD and Knudsen AK, 2005. The use of virtual expert panels: formulary decision-making in the 21st century. Formulary, 40(3).
Objective of the document	This article describes the creation and use of a "virtual" panel of experts utilising anonymous electronic communications to assist the P&T (Pharmacy & Therapeutics) committee at a university-based teaching hospital in making medication use policies. The article includes a detailed description of the P&T committee's experience in the selection of virtual panel members, methods used, advantages, potential pitfalls, and the outcomes of a virtual committee.
Territorial coverage	There is no specific territorial coverage.
Methodology	Case study
Themes	Digitalisation, digital instruments (e.g., artificial intelligence) Health, environment, food, sustainability
Main findings	The article discusses how decision-making within the pharmaceutical and therapeutic (P&T) committee can be complicated, especially in the case of drugs, as the subject matter is often complex and lacks comprehensive evidence. For these reasons, ad hoc committees of experts are needed to assist P&T committees. Expert panel participation can be a considerable amount of work for the participants and therefore their use is limited. To reduce these problems, the article introduces the possibility of virtual expert panels, where most communication is done via email.
Specific elements on group decision-making	Cost is a major variable that influences decision-making. The use of standing subcommittees is one approach to handling issues that requires special expertise or extra deliberations that the time constraints of P&T committee meetings will not permit. However, the use of standing subcommittees can be burdensome. Virtual expert panels can be useful to P&T committees. Used appropriately, there are several potential benefits: • The process allows for the detailed evaluation of large amounts of scientific data. • Concise recommendations based on specific questions can be generated in a reasonable time frame. • The use of e-mail communications avoids the logistics of finding mutually agreeable meeting times for busy faculty and clinicians, which can delay the resolution of drug-related problems.

	• Anonymous e-mail communications allow for equal input by all members of the expert panel and to avoid the potential for influence by colleagues. "Virtual" expert panels avoid the logistics of finding mutually convenient meeting times and allow participants ample time to consider facts and reflect on solutions, thereby streamlining the formulary decision-making processes.
Lessons learnt or recommendations	Lessons learnt: It would be important to preserve the anonymity of the members of the group, so that no members are allowed to dominate the discussion. Thanks to the panel members' anonymity, participants can change their position on an issue without being concerned about appearances or peer-pressure issues. Electronic communications appear to be most efficient when questions are defined a priori. The virtual expert panel works well when the charge of the panel is well-defined. When the clinical issues are not as well defined, the virtual nature of the discussion may prevent the necessary interaction to define the issues.

Factsheet 19

Name of the publication	Schott C, Van Kleef DD and Steen TP, 2018. The combined impact of professional role identity and public service motivation on decision-making in dilemma situations. International Review of Administrative Sciences, 84(1), pp.21-41.
Objective of the document	This study aims to increase our understanding of whether public service motivation (PSM) and professional role identity are useful concepts to predict what decisions public service professionals will make in complex situations.
Territorial coverage	This study contributes to the recent debate on the universal applicability of the PSM (Public Service Motivation) scale by applying it to the case of Dutch veterinary inspectors.
Methodology	Case study
Themes	European approaches in regulatory science
Main findings	The article specifically deals with situations in which decisions are taken in a public governance context. The decision-making process in public administration can be difficult, as a balance has to be struck between 'traditional' values (integrity, neutrality and legality) and 'corporate' values (efficiency, responsiveness and effectiveness). This study seeks to understand what role professional role identity (PRI) - i.e. individuals' perception of their professional role - and public service motivation (PSM) - i.e. an individual's orientation towards providing services to people to do good for others and society - play in the decision-making process within the public service. To achieve this, the study uses the insights of identity theory, i.e. the theory that describes how individuals engage in activities that identify their identity. To understand this, first, the authors refer to the literature on the subject and then an experiment is carried out concerning the universal applicability of public service motivation by testing it on the case of Dutch veterinary inspectors.
Specific elements on group decision-making	Including the concept of professional role identity in the study of decision-making in the context of dilemma situations is useful to learn more about what drives public service professionals' decision-making. Decision-making is influenced by professional role identity.

Lessons learnt or recommendations	Lessons learnt: PSM has no explanatory value of decision-making in situations in which values are conflicting; PSM alone is not sufficient to explain how individuals will act; PSM might not be universally applicable to individuals belonging to specific professions. The fact that there are different professional role identities challenges the fundamental assumption in the sociology of professionalism that professionals with the same occupational background share one single professional identity and act accordingly. It is still not sure whether PSM moderates the relationship between the way individuals interpret their professional role and the decisions they make in dilemma situations. The results showed that PSM did not have a direct effect on decision-making in the context of dilemmas either. This provided support to the critique that it is not enough to know the strength of PSM if we want to predict how an individual will behave in the context of dilemma situations.

Factsheet 20

Name of the publication	Brodbeck FC, Kerschreiter R, Mojzisch A and Schulz-Hardt S, 2007. Group decision making under conditions of distributed knowledge: The information asymmetries model. Academy of Management Review, 32(2), pp.459-479.
Objective of the document	This paper presents a theoretical model that synthesises and expands current explanations of the failure of decision-making groups to effectively use information that is distributed among their members.
Territorial coverage	The geographical area is not defined.
Methodology	Literature review
Themes	How to integrate new ways of working
Main findings	The article proposes a theoretical model that focuses on how asymmetries in information distribution prior to and during group decision-making interact to influence the quality of group decisions and related variables. The article presents a theoretical model that synthesises and extends explanations for the inability of decision-making groups to make effective use of information distributed among their members.
Specific elements on group decision-making	Group decision-making is more costly than individual decision-making or opinion polls. It necessitates the copresence of several individuals, and it is more time-consuming owing to information exchange and discussion. Research has shown that participation in group decision making increases perceptions of fairness and the acceptance of the decisions made, allows for higher identification with the decision, and results in stronger commitment to the decisional implications. The pre-discussion distribution of information determines whether group discussion can result in superior decision quality. In their seminal study, Stasser and Titus (1985) introduced this asymmetric information distribution (or the hidden profile) – where the best-informed decision alternative is hidden from individual group members prior to discussion. In the case of a hidden profile, group members enter the discussion preferring a suboptimal alternative and can only reach a correct decision by pooling and integrating the unshared information during the discussion. In the group decision-making literature, a basic distinction is made regarding how groups exert social influence on their members:

Normative influence – individuals who dissent from the dominant position held in the group tend to conform because they are motivated by the desire to please others, to gain social approval, or to avoid others' rejection.
Informational influence - an individual's opinion change results from learning new information and re-evaluating the preferred decision alternative in light of the fresh information.
At the group level of information processing, there is an observable pattern of social interaction that serves the exertion of normative influence: negotiation focus — that is, group members focus on exchanging and negotiating opinions and preferences so that the dominant or majority position can be identified and settled within the group. Research about this topic brings to two propositions:

1. A group's negotiation focus hinders individual learning of new information.
2. A group's negotiation focus has negative effects on group decision quality if decision-relevant knowledge is distributed in the form of a hidden profile.

There are further biases characterising the exchange of information during a group discussion:

- Sampling bias – compared to unshared information, shared information is proportionally more often brought up first during discussion.
- Repetition bias - shared information is proportionally more often repeated during discussion than unshared information.
- Evaluation bias favouring shared information – shared information is judged more credible and more important than unshared information.
- Evaluation bias favouring preference-consistent information - people evaluate information in relation to preferences they have developed.

All of that brings to other propositions:

3. The discussion bias and evaluation bias in favour of shared information hinder individual learning of new information.
4. The discussion bias and evaluation bias in favour of shared information have negative effects on group decision quality if decision-relevant knowledge is distributed in the form of a hidden profile.
5. The discussion bias and evaluation bias in favour of preference-consistent information hinder individual learning of preference-inconsistent new information.
6. The discussion bias and evaluation bias in favour of preference-consistent information have negative effects on group decision quality if decision-relevant knowledge is distributed in the form of a hidden profile.
7. In the case where several or all asymmetries are working simultaneously, stronger effects should be expected.

Lessons learnt or recommendations

Lessons learnt:
To improve the quality of group decision-making, one must focus on eliminating information asymmetry. Another way to do so is through information management, which consists of continually encouraging decision-relevant contributions and keeping them alive in the group discussion by asking questions about factual information and deliberately repeating obviously unsupported information.
In addition, high-cost interventions have a greater individual impact on the quality of group decisions.

Factsheet 21

Name of the publication	Millstone E, 2007. Can food safety policy-making be both scientifically and democratically legitimated? If so, how?. Journal of Agricultural and Environmental Ethics, 20, pp.483-508.
Objective of the document	This paper analyses the evolution of the way of thinking and talks about the role of scientific knowledge and expertise in the definition of food safety policies and, more generally, in the definition of risk policies, from the end of the 19th century to the present day.
Territorial coverage	The geographical area is not defined.
Methodology	Literature review
Themes	Health, environment, food, sustainability Science for policy
Main findings	The article begins by recalling how food safety policy is a highly contested field. There are not only disputes about the safety and acceptability of particular products and processes, but also about how food safety should be assessed and how policy issues should be decided. By the 1980s, governments had used science as a political and ideological resource. However, public scepticism about the reliability of knowledge and expert opinions had reached such a point that scientific bodies had lost much of their credibility resulting in their opinions no longer being enough for legitimizing public policy decisions. The author then sets out an excursus of the various stages of the evolution of theories of science in politics: • the 'decisionist' models (Weber and Durkheim) - Weber argued that politicians should take responsibility for defining public policy objectives and that bureaucrats should be subordinate to democratically accountable ministers. The decision-making process should comprise two separate sets of deliberations and, consequently, two separate lines of responsibility. Ministers should be accountable to the legislature for decisions on the choice of policy objectives and, through it, to the electorate. Bureaucrats and experts, on the other hand, should be accountable to the ministers and the legislature for effectively pursuing the goals set from above, and to their official colleagues and selected groups of professional experts for the knowledge and judgments made in the exercise of their responsibilities; • technocratic models (Compte and Saint Simon)- a government run by those with vested and partial interests was to be replaced by a government run by scientific and technological experts. Technocracy assumes that scientific and technical considerations are not only necessary but also sufficient for decision-making (e.g. British BSE policy); • risk governance after 1945 - development of a series of alliances between, on the one hand, a fraction of the scientific community that discovered they could gain influence over policy-making processes and, on the other hand, the officials and elected representatives responsible for the administration of these processes. This part of the scientific community, however, often came from the industries and companies whose products and processes were to be evaluated. Decision-making was informed by science, but science itself was supposed to remain completely apolitical; • reverse 'decisionism' in the US - in this inverted model, it is scientists who identify the goals to be achieved, while politicians are called upon to decide how the goals derived from science are to be achieved. Inverted decisionism has also been adopted as a design principle for the structure of political institutions and their

procedures. Scientific advisory committees have been set up, which are routinely asked to provide opinions on policy issues. These opinions are then forwarded to and received by a separate part of the bureaucracy that is responsible for conducting and finalising decision-making processes;

- European Approaches - Before March 1996 - science-based decision-making was commonly represented in a technocratic manner and conducted behind closed doors through opaque and unaccountable processes in which science and politics were 'hybridised': the selection and interpretation of scientific evidence and advisors were sensitive to the political contexts in which experts developed and articulated their advice;
- the 'Red Book' model - the Red Book model is structurally indistinguishable from the inverted decisionist model but has been relabelled using the terms 'risk assessment' and 'risk management'. The model recommended to not institutionally separate risk assessment from risk management, as risk assessment was considered to be an inherently hybrid activity;
- European developments after March 1996 – the institutionalisation of the division of labour between 'risk assessment' and 'risk management';
- the co-evolutionary model of science and politics - risk representations are hybrid judgments constructed on the basis of both scientific and non-scientific considerations, even though they may be represented as purely scientific.

Specific elements on group decision-making	Numerous scholars have provided detailed evidence demonstrating that the only reason why regulatory institutions were able to represent their decision-making processes with technocratic or decision-making models was that they constructed representations of the scientific aspects of risk in strictly consensual terms, selectively underestimating uncertainties and concealing key non-scientific assumptions. To support these arrangements, policy-makers carefully selected as consultants only scientists who could be relied upon to provide advice that was broadly consistent with the ministers' and senior officials' previous policy objectives and commitments, and who were likely to accept technocratic or decisionist representations of the decision-making process. The historical, institutional, economic, and cultural aspects of the contexts in which scientists work (especially scientists chosen to provide official advice to public decision-makers) condition: • the agendas they address and those they avoid, • the types of questions they try to answer and those they neglect or avoid, • the types of evidence they consider relevant and those they disregard or ignore. • how evidence is selected and interpreted. Very often panels come to different conclusions because they answer different questions. The Codex Alimentarius Commission defines 'risk assessment policy' as follows: • The determination of the risk assessment policy should be included as a specific component of risk management. • The risk assessment policy should be established by risk managers following a risk assessment, in consultation with risk assessors and all other stakeholders. This procedure aims to ensure that the risk assessment is systematic, comprehensive, impartial, and transparent. • The mandate given by the risk managers to the risk assessors must be as clear as possible.

	• If necessary, risk managers should ask risk assessors to evaluate potential risk variations arising from different risk management options.
Lessons learnt or recommendations	The co-evolutionary model of the relationship between scientific considerations on the one hand and political and ethical considerations on the other provides a more accurate and adequate representation of how, in practice, politics, ethics, and science interact in food safety decision-making than any previous model. This model recognises the existence of interactions upstream and downstream of science; scientific representations of food safety risks are influenced by previous evaluative judgments, even if risk assessors and managers choose not to recognise this. If risk assessors explicitly recognised the uncertainties as well as the ethical and political assumptions that guide their scientific assessments, then scientific and democratic legitimacy could be achieved more effectively through decision-making processes.

Factsheet 22

Name of the publication	Irwin A, Rothstein H, Yearley S and McCarthy E, 1997. Regulatory science—towards a sociological framework. Futures, 29(1), pp.17-31.
Objective of the document	This article considers the concept of 'regulatory science' and its practical and theoretical significance within contemporary debates concerning regulatory science and policy. The paper considers especially the possible emergence of regulatory science in the area of toxic chemicals control in the European Union, with a focus on the activities of the British agrochemical sector.
Territorial coverage	The geographical area is not defined.
Methodology	Literature review
Themes	European approaches in regulatory science
Main findings	The main purpose of the article is to identify the common characteristics of regulatory science. To do so, the authors begin with a brief review of previous academic and political discussions on the subject. Regulatory science deals with how science can make predictions based on uncertainties. Several differences between academic and regulatory science are emphasised: academic science is seen as open, innovative, subject to peer review, and undertaken to advance knowledge, whereas regulatory science is portrayed as constrained by external pressures of time and politics, closure-oriented, proprietary, subject to various types of review and undertaken to aid decision-making. However, this is not the only definition of regulatory science: the institutional culture of regulatory science varies from country to country, so much that cross-country comparisons suggest significant variations in assigning it meaning. To move towards a definition, five categories that can be grouped within the science of regulation have been identified: 1. Speculative research - academic research on topics that may have regulatory relevance (e.g. chemical toxicity or environmental risk). 2. Development and validation of regulatory testing - specific tests must be developed and validated so that chemicals can be screened for potential hazards. 3. Regulatory Compliance Testing - Industry Screening Test

	4. Investigative Problem Solving - further investigation to identify whether results are false positives. 5. Regulatory submission - Compilation of information dossier for regulatory review and completion of internal risk assessment. Some heterogeneous features of regulatory science are identified: • scientific activity as situated within academic, industrial, and governmental contexts; • activities that bring together a range of specialisations and disciplinary orientations and embrace various levels of scientific uncertainty/uncertainty; • intellectual and practical activities that to varying degrees range between the technical and the bureaucratic; • concerns that are inevitably scientific, economic, and political in nature; • activities encompassing both regulation and innovation. To test the validity of this categorisation, the authors focus on a specific area of regulatory science, namely the regulation of agrochemicals.
Specific elements on group decision-making	The ways in which industrial scientists can decide, for example, which scientific evidence is significant and which can be ignored, and how this evidence should be interpreted, do not depend solely on objective criteria but are intimately linked to their institutional and cultural environment. It seems possible that regulatory science excludes groups that cannot play an intimate role in the largely confidential negotiations.
Lessons learnt or recommendations	The area of regulatory science seems to be ignored within most policy discussions on the national and international science base, a trend that may have been encouraged by previous denigrating treatments of regulatory science. Regulatory science is an important test case for the flexibility of modernist institutions, including those of science and industry, in incorporating environmental values while operating within important constraints. The tension within regulatory science between rule-based standardization (as demanded by international governmental and industrial institutions) and flexible models of innovation and scientific inquiry (which the same institutions claim to value) represents a major challenge for scientific regulatory bodies.

Factsheet 23

Name of the publication	Rothstein H, 2013. Domesticating participation: Participation and the institutional rationalities of science-based policy-making in the UK Food Standards Agency. Journal of Risk Research, 16(6), pp.771-790.
Objective of the document	This article explores the institutional factors that determine the impact of public participation on the processes and outcomes of science-based decision-making.
Territorial coverage	The geographical area is not defined.
Methodology	Case study
Themes	Health, environment, food, sustainability How to integrate new ways of working Citizens' involvement in the decision-making process
Main findings	The article discusses the different forms of science-based institutional rationales of policy-making that shape the practical implementation of participatory exercises. To do so, the paper takes as a case study the attempts to institutionalise public participation in the UK food policy over the last decade. The article brings together research on four types of participatory practices in food security policymaking from the 1990s to the

present and, in so doing, provides a longitudinal analysis of how and why the conception and practice of participation have changed over time.
Historically, British governance was characterised by a strong 'club culture', in which decisions were reached through informal understandings between the government, major businesses, and professional groups, under the cloak of a broad Official Secrets Act.
A series of food safety scandals in the 1980s and 1990s, culminating in the BSE crisis, contributed to the defeat of the Conservative government in 1997 and the replacement of MAFF (Ministry of Agriculture, Fisheries and Food) with the FSA (Food Standards Agency) in 2000 by the New Labour administration.
The FSA was established as a dedicated non-ministerial government department with a mission encapsulated in three guiding principles: 'putting consumers first'; being 'open and accessible'; and being 'an independent voice'.

Specific elements on group decision-making

The article examines four different approaches to public involvement in the FSA decision-making process:
Ad hoc consultation - actively seeking views in response to policy documents or organising meetings with stakeholders. In this precise case, success did not depend on the adaptation of political processes to the pressures of widening participation. Rather, success depended on the ability of consumer groups to adapt, and indeed to reinforce, traditional political processes and cultures that emphasise consensus. Ad hoc groups may have difficulty making substantial contributions in one-off consultation processes or may lack sufficient organisational resources to build and maintain the legitimacy of their technical contributions within an extended political network over a long period.
Stakeholder decision-making process - dedicated stakeholder decision-making processes in which stakeholder representatives are enlisted as active participants in the formulation of policy options rather than as passive ad hoc advisors. Such processes offer the opportunity to directly and responsibly represent stakeholders' interests in the decision-making process. At the same time, however, these processes are time-limited; the outcomes are likely to be sensitive to the particular stakeholders selected as participants and policymakers who face potential control issues.
Consumer committees - They include lay and elite consumer representatives and potentially offer an effective means of understanding consumer perspectives and an opportunity to co-opt opinion leaders. However, committees pose potential challenges in terms of the depth of their members' understanding of policy issues, their legitimacy in representing public opinion, and their precise constitutional role in representing consumer interests.
In this particular case, the Committee was initially welcomed by all, but soon came into conflict with the FSA for three reasons:

1. problems arose over the Committee's contribution to the understanding of political problems;
2. disputes emerged over whether the Committee was capturing an adequate breadth of views;
3. tensions emerged over the Committee's constitutional role within the Agency.

Research on lay consumers – a direct collection of evidence of consumer attitudes gathering primary evidence of consumer opinions has the potential to better represent mass public opinion, but clearly requires more resources than relying on elite interlocutors.

Lessons learnt or recommendations	The processes that had the greatest impact on decision-making were those that could be adapted to established methodological norms, policy-makers ideas on legitimate competencies, and the organisational requirements of decision-making cycles. The processes of domestication have clearly shaped the impact of participation on policy outcomes, insofar as the participatory processes that had the greatest impact were those that best countered institutionally entrenched ideas about how to serve the 'public interest'. Participation is unlikely to succeed without being domesticated to fit the 'institutional rationales' of science-based policymaking.

Factsheet 24

Name of the publication	Sharman N, Wallace CA and Jespersen L, 2020. Terminology and the understanding of culture, climate, and behavioural change–Impact of organisational and human factors on food safety management. Trends in Food Science & Technology, 96, pp.13-20.
Objective of the document	The objective of this study is to analyse the similarities and differences in the current definitions and statements of Food Safety Culture and Food Safety Climate, and to provide suggested clarifying definitions for both concepts to bring a consistent approach to the field. The study evaluates the types of organisational cultures, climates and employee behaviours that provide important differences and distinctions between these concepts.
Territorial coverage	The geographical area is not defined.
Methodology	Literature review
Themes	Health, environment, food, sustainability
Main findings	The article attempts to answer the question of what kind of culture is prevalent within food safety management systems, and how it can be understood and used to prevent food-borne disease outbreaks. There are still no consistent definitions of food safety culture and climate for practitioners and researchers. Published research has expressed conflicting views between definitions of culture and climate, whether from an organisational, people safety, or food safety perspective. This could potentially confuse organisations trying to understand their culture and climate, and further research is needed to see if this has an impact on the organisation when it is in the process of changing its approach to food safety. The objectives of this study are to compare and contrast current definitions and statements of culture and climate (organisational, safety, and food safety), to provide suggested definitions for both concepts, to review and discuss knowledge on the different types of climates and cultures to provide information on the types of culture and climate, as well as to outline important differences and further insights into the impact of employee behaviour on culture and climate. The method by which this study was conducted is a literature review. A summary of the definitions and statements of the terms climate and security is then presented. The resulting findings are that culture can be regarded as what distinguishes one group or organisation from another. The authors then go on to propose definitions with respect to food safety culture and the food safety climate: • Food safety culture - defined as a long-term construct existing at the organisational level, which refers to deeply ingrained beliefs, behaviours, and assumptions, learned and shared by all

	employees, that have an impact on the organisation's food safety performance. • Food safety climate - defined as a temporary construct that exists at the individual level, which relates to the perceptions and attitudes of individuals and how they influence others in an organisation to adhere to food safety management systems and to apply them in practice in their working environment.
Specific elements on group decision-making	Due to the depth with which the culture is embedded within the organisation, it is difficult to manipulate and change the culture. Yiannas (2009) believes that organisations can choose to create a strong food safety culture with leaders responsible for promoting it, as they have the power and influence to create a positive food safety culture. With a good food safety management system (FSMS), and with a positive culture of compliance, risks to consumers can be reduced. This may be due to a combination of leadership, communication and FSMS compliance, which found that a company with multiple food processing sites had a better food safety climate than a company with only one site.
Lessons learnt or recommendations	Perception is a key factor in organisational climate, as people's perceptions can change depending on the information and other conditions around them. The analysis of different types of organisational cultures allowed to highlight the fact that an ideal team would include a combination of mission and involvement cultures, as well as task culture and relationship culture. The combination of all these behaviours within a team would improve its internal communication, develop the competencies of its members, and therefore allow the objectives to be better achieved.

Factsheet 25

Name of the publication	van Rijssen FWJ, Eloff JN and Jane Morris E, 2015. The precautionary principle: Making managerial decisions on GMOs is difficult. South African Journal of Science, 111(3-4), pp.1-9.
Objective of the document	The article addresses the issue of insecurity concerning the interpretation of the precautionary principle (PP). It reviews the description of the PP, the debate on its interpretation as well as the conclusions reached by various authors, seeking to use it as a tool to aid decision-making.
Territorial coverage	The results can be applied everywhere, but there is a special focus on the African situation.
Methodology	Case study
Themes	Health, environment, food, sustainability Science for policy
Main findings	The paper begins by highlighting how there is a lack of consistency in the decisions taken by governments to control genetically modified (GM) crops. There are many reasons for this, one of which is the variable application of precaution in decision-making, in particular the different interpretations of the precautionary principle (PP). To shed light on these different interpretations, the authors first try to make clear the descriptions of the terms and concepts covered, such as the concept of risk. It describes the probability of an adverse effect and the severity of that effect, resulting from one or more hazards or threats. In scientific terms, zero risk is non-existent. The need for a precautionary approach to possible environmental threats and human health concerns is illustrated by several South African laws. South Africa has published several guidance documents. However, the different South African government departments represented on the GMO

	Council seem to have different positions. The absence of specific policies is evident in the recent mandatory labelling requirements for GMOs. The article then goes on to observe what the precautionary principle (PP) is: 'precaution' is generally recognised - not as a hypothesis, theory, or methodological rule - but as a normative principle for making practical decisions under conditions of scientific uncertainty. The mandatory nature of this regulatory principle has led to the development not only of criteria for policy design but, when included in the legislation, the principle has created a 'regulatory philosophy' that, in turn, must be interpreted by legislators. At the heart of the PP lies the obligation to act to reduce damage to the environment and human health and the moral obligation to act even if the scientific evidence is inconclusive. Central to the debate on the precautionary principle are the degree of scientific uncertainty in risk assessment and what decisions should be made by managers in the face of uncertainty, when to apply precaution, as well as what precautionary measures should be taken to achieve certain levels of protection. These ideas can be grouped into two closely related issues: how risks are perceived by different people, and how regulators deal with these risks. The PP is open and undefined, which gives regulators almost unlimited discretion to impose restrictions. The article goes on to illustrate the case study concerning the assessment of endogenous allergens and, more generally, illustrates some of the complexities decision-makers may face in risk governance.
Specific elements on group decision-making	The main problems inherent in the application of the PP and the corresponding precautionary approach are (1) substantive issues such as determining the plausibility, nature, and severity of possible harm, and (2) procedural issues, e.g. optional versus mandatory precaution, and the need for further research and policy development. At the very least, it is important to agree on the importance of procedural steps in cases of great uncertainty about available evidence, possible consequences, viable options, long-term effects, and minority opinions. The International Risk Governance Council has developed a framework to assist governments in in facing all types of risk in the context of decision-making. The creators of the International Risk Governance Council framework emphasise the importance of stakeholder participation. In a democratic political situation and to improve the credibility of risk governance, better interaction with stakeholders must be considered. Participation must be properly defined, as responsibility remains with the regulator.
Lessons learnt or recommendations	Instead of gaining more knowledge about uncertainties, alternative management strategies, such as manageable human interventions, could be proposed. Additional and stricter control, to the point of avoiding any risk as a precautionary measure, could be detrimental to progress. In these situations, it is difficult to navigate without clear policies at every level of decision-making. Consumer risk policies should be placed in the broader context of the country's needs. Approaches included in a risk assessment policy interface should be followed, which does not exist in many risk governance situations. The consequences of additional precautionary requirements that are not well thought out are far-reaching.

Factsheet 26

Name of the publication	Bolger F and Wright G, 2017. Use of expert knowledge to anticipate the future: Issues, analysis and directions. International Journal of Forecasting, 33(1), pp.230-243.

Objective of the document	This article attempts to explain the technique for risk assessment called EKE (expert knowledge elicitation techniques).
Territorial coverage	The geographical area is not defined.
Methodology	Literature review
Themes	How to integrate new ways of working Science for policy
Main findings	The article begins by emphasising how risk assessment can be seen as a way of anticipating the future and, how it needs a theoretical model of the world to be applied in order to make such predictions. All stages of the anticipation process require, to a greater or lesser extent, the input of people, preferably individuals with some experience in the field. One area that has attracted much attention in recent years is the development of methods to elicit expert estimates of the parameters of risk assessment models. These elicitation methods applied to risk analysis are known as 'expert knowledge elicitation techniques' (EKE). EKE is not a single method, but an approach encompassing several existing modelling approaches and their related methods applied so far in a rather narrow sense to the elicitation methods used for risk analysis. Particular characteristics define EKE: 1. it is a practical undertaking that applies the results of social science research to the problem of extracting the best possible estimates from people in the absence of concrete evidence and the presence of uncertainty, to be used for specific purposes; 2. it is concerned with identifying and measuring the expertise of experts. The best way of representing uncertainty and eliciting it from experts is one of EKE's main concerns; 3. an important distinction in EKE is between substantive competence, which is the domain or content knowledge, and normative competence, which refers to agreed methods, benchmarks, and measures. Although in EKE one is usually primarily concerned with substantive competence, the possession of adequate normative competence can also be important; 4. knowledge is usually obtained from more than one expert; 5. the question of whether and how experts interact with each other is another important concern of EKE. EKE aims to collect expert knowledge as impartially as possible, but it has been shown that freely interacting groups are subject to biases such as groupthink, which leads to 'process loss'. On the other hand, the limited exchange of information in non-interacting groups means that the 'process gain' (i.e. the advantage gained by discussing and pooling the knowledge of different experts) may not be as great as it could be; 6. making expert judgments that are free of bias.
Specific elements on group decision-making	Application of EKE to anticipation problems according to the stages of Amstrong's forecasting process (which deals with the anticipation of the future more generally): • implementation - a model is formulated; relevant variables are identified, and a data search is initiated. Scenario planning facilitates the modelling of perceptions and provides documentation; • the choice of method - the longer the forecast horizon, the less reliance can be placed on previously collected data sets on the predicted variable, and the more recourse must be had to expert judgment. At the core of the EKE approach is the expert whose competencies must be well assessed. Some indication of an

expert's level of competence can be obtained by examining his or her CV, e.g. academic and professional qualifications, years of professional experience, number of publications, patents and citations, awards, and so on. Another source is the opinion of colleagues, in the form of references or answers to a questionnaire such as the Generalized Expertise Measure. CVs should be preferred to peer evaluation, which in turn should be preferred to self-assessment, which is better than social competence.

EKE is concerned with how the judgments of different experts can best be aggregated into a single judgment in the context of decision-making and policymaking. There are three basic approaches to aggregation:

1. behavioural: experts interact, hoping to eventually reach a consensus that can be used for policymaking;
2. mathematical: experts make their judgments individually, which are then combined into a single forecast by averaging the judgments;
3. mixed.

Application of the method - the first step is the selection of experts, which can be done according to two strategies: 1) sampling a larger number of less qualified experts or 2) sampling a smaller number of highly qualified experts. After selection, expert training takes place.

Evaluation and documentation - performance should be evaluated whenever possible, and the results provided as feedback to relevant personnel to improve the quality of future predictions. The question arises as to how best to evaluate performance. In addition to reporting on the quality of forecasts (and inputs), the entire forecasting process should be documented as comprehensively as possible to further improve local and community outcomes.

As we have seen, the dependency between experts' knowledge is another theme in the EKE literature, which is relevant when considering the judgments of multiple experts. If there is a high level of homogeneity in expertise, then there is little to be gained by sampling multiple experts because they will tend to agree. Moreover, many mathematical aggregation methods assume the idea of independence between expert judgments, so excessive homogeneity may impact the accuracy of judgments, unless dependencies are taken into account. Various methods have been proposed to introduce heterogeneity into expert groups, such as the 'devil's advocate' and the 'dialectical survey' to overcome this problem. At the same time, however, if the heterogeneity is too great, reaching a consensus may be difficult, and aggregation may not make sense.

Lessons learnt or recommendations

The main message is that expert judgments must be considered as data and, as such, the methods used to obtain and work with this data (i.e. EKE) must be such to maximise the reliability and validity of the data (as is the case with any empirical method). There are several ways to ensure the reliability and validity of the expert judgment, most of which are not mutually exclusive and can therefore be combined:

- Measuring the normative and substantive competence of potential experts through tests, self-assessment questionnaires, evaluations by others, experience indicators, as well as by using these measures of competence to select, assess and evaluate experts;
- Use such measures of competence to select, screen, or weigh experts;
- Use such measures to identify training needs and train accordingly;
- Eliminate noise through the careful use of well-designed elicitation protocols that include the use of appropriate scoring rules, rich feedback on judgments, and opportunities to reflect and revise judgments;
- Use well-designed and administered protocols that avoid framing, availability, representativeness, and anchoring effects when

discussing individual judgments, and also provide anonymity and facilitated information exchange when discussing group judgments;
- Collect as much data as possible, balancing the costs and benefits of increasing the sample size (bearing in mind that there may be a trade-off between sample size and the degree of expertise of the participants).

Factsheet 27

Name of the publication	Decuyper S, Dochy F and Van den Bossche P, 2010. Grasping the dynamic complexity of team learning: An integrative model for effective team learning in organisations. Educational Research Review, 5(2), pp.111-133.
Objective of the document	This article provides an overview of factors contributing to effective team learning.
Territorial coverage	The geographical area is not defined.
Methodology	Literature review
Themes	Collaborative teamwork
Main findings	The article explains a team learning model based on three essential processes: 1. Sharing - communicating knowledge, competencies, opinions or creative thoughts of one team member to other team members 2. Co-construction – team members engage in repeated cycles of acknowledging, repeating, paraphrasing, enunciating, questioning, concretising, and completing the shared knowledge, competencies, opinions or creative thoughts 3. Constructive conflict - process of negotiation or dialogue that uncovers diversity in identity, opinion, etc. within the team. In addition to these, efficiency and effectiveness of teams are influenced by facilitating factors: 1. Team reflexivity – members need to have a clear vision on where they stand (current reality), what they want to reach (ultimate team goals), and how they want to reach it (team methods and instrumental team goals) 2. Team activity - process of team members working together, mobilising physical and psychological means required for goal attainment 3. Boundary crossing - share knowledge, competency, opinions or creative ideas across the team boundaries with the different stakeholders in the learning process 4. Storage and retrieval - shared knowledge, developed procedures, shared ideas, plans, habits, etc. that result from basic and facilitative team learning processes are saved in the 'software' and/or the 'hardware' of the team, in such a manner that they can serve for later use or subsequent inspection.
Specific elements on group decision-making	A review of the variables most commonly discussed and having the greatest effect on team learning resulted in the following list. • Shared mental models: team member's shared, organised understandings and mental representations of knowledge about key elements of the team's task environment • Team psychological safety: sense of confidence that the team will not embarrass, reject, or punish someone for speaking up

	• Group potency/efficacy: general collective belief that the group can be effective • Cohesion: shared commitment among members to achieve a goal that requires the collective efforts of the group • Team development and team learning dynamics: typical stages of team development include a) Forming, b) Storming, c) Norming, d) Performing, e) Adjourning • Team leadership • Interdependence: individuals perceive that they can reach their goals if and only if the other individuals with whom they are cooperatively linked also reach their goals and, therefore, promote each other's efforts to achieve the goals • Team structure • Organisational strategy • Team members systems thinking: successful teamwork depends on the capabilities and the characteristics of the team members. Team tenure – defined as "the average number of years each member had worked in the team" – predicts neither team psychological safety, nor team learning behaviour. Hirst (2009), however, recently demonstrated a moderating role of team tenure for the relationship between membership change and team learning behaviour. In newly formed teams, membership change has positive effects, whereas in long-serving teams the effects are negative.
Lessons learnt or recommendations	The main message is that expert judgments must be considered as data and, as such, the methods used to obtain and work with this data (i.e. EKE) must be such to maximise the reliability and validity of the data (as is the case with any empirical method). There are several ways to ensure the reliability and validity of the expert judgment, most of which are not mutually exclusive and can therefore be combined: • measuring the normative and substantive competence of potential experts through tests, self-assessment questionnaires, evaluations by others, experience indicators, as well as by using these measures of competence to select, assess and evaluate experts; • use such measures of competence to select, screen, or weigh experts; • use such measures to identify training needs and train accordingly; • eliminate noise through the careful use of well-designed elicitation protocols that include the use of appropriate scoring rules, rich feedback on judgments, and opportunities to reflect and revise judgments; • use well-designed and administered protocols that avoid framing, availability, representativeness, and anchoring effects when discussing individual judgments, and also provide anonymity and facilitated information exchange when discussing group judgments; • collect as much data as possible, balancing the costs and benefits of increasing the sample size (bearing in mind that there may be a trade-off between sample size and the degree of expertise of the participants).

Factsheet 28

Name of the publication	Dalal S, Khodyakov D, Srinivasan R, Straus S and Adams J, 2011. ExpertLens: a system for eliciting opinions from a large pool of non-collocated experts with diverse knowledge. Technological Forecasting and Social Change, 78(8), pp.1426-1444.
Objective of the document	This article provides an overview of a system for expert knowledge elicitation.

Territorial coverage	The geographical area is not defined.
Methodology	Experiment
Themes	Effective expert knowledge elicitation
Main findings	ExpertLens has four goals: (1) to expand the pool of participants who are considered "experts" without making the definition of an expert meaningless; (2) to create an iterative, structured online system that helps non-collocated participants with various levels and domains of expertise share their ideas and interact with each other by using online discussion boards; (3) to develop a seamless approach for integrating quantitative (votes) and qualitative input (online discussion comments) from participants; and (4) to employ statistical modelling techniques as a means to making decisions based on the input from diverse groups of panellists. The process is organised in the following steps of knowledge elicitation: Round 0 (optional): ideas generation Round 1: estimation Round 2: group feedback, previous individual responses, and anonymous online discussions Round 3: re-estimation Post-completion survey: "truth" questions, experience with ExpertLens questions, demographic questions.
Specific elements on group decision-making	Factors contributing to facilitation of group communication: 1. Feedback - the greatest improvement in accuracy of participants' judgments occur with reasons feedback, followed by statistical feedback, and reiteration of respondents' own answers from the previous round conditions. 2. Mode of interaction - because ExpertLens elicits opinions from a large group of non-collocated individuals, Round 2 discussions among participants are asynchronous, which allow panellists to participate at a time convenient to them. 3. Anonymity - assign unique IDs (pen names) to all participants, which are displayed during the discussion round. 4. Information aggregation - ExpertLens methodology uses the Bayesian approach and combines quantitative ratings and rankings with qualitative explanations provided by participants to evaluate variation in responses and to understand why participants change their answers between rounds. 5. Data - ExpertLens analyses quantitative, categorical, and text data from all rounds of the elicitation. The data analysis takes place in four stages: preliminary data analysis, analysis of agreement, data modelling, and analysis of changes in responses.
Lessons learnt or recommendations	• Psychologists argue that when the number of participants becomes too large (e.g., more than ten), the collective ceases being a "group" and can be considered a "crowd," in which meaningful face-to-face interactions are not feasible and achieving consensus may be difficult. • Asynchronous communication seems to be the most efficient means of interaction in non-collocated groups. In comparison to collocated groups, asynchronous groups may experience benefits by allowing participants to focus on a wider range of issues, pool more information together, and discuss multiple issues in a parallel fashion. • To minimise the chances of process losses during asynchronous interaction, online discussions have to be properly structured, participants should be appropriately incentivized to share their expertise with others.

- On the one hand, anonymity may foster more dynamic and rich discussions because participants may be more inclined to be honest, and they can evaluate each other's contributions on the perceived value of the argument, avoiding any bias based on who proposed it. On the other hand, researchers have noted with concern the presence of free riding behaviours, "flaming," irrelevant comments, and antagonistic behaviour in systems that force participants to remain anonymous, which can negatively impact participation and productivity of group interaction Therefore, anonymity creates a tension between the ability to empower more candid behaviour and the need to prevent counterproductive exchanges between participants. One of the solutions offered in the literature is the use of "pen names" or user IDs.
- Although traditional approaches to expert elicitations rely on consensus, research suggests that statistical data modelling of individual panellists' responses may be a viable alternative. By not requiring participants to come up with a consensus-based decision, the ExpertLens methodology can help elicit opinions more efficiently.

Factsheet 29

Name of the publication	Faulkner A and Poort L, 2017. Stretching and challenging the boundaries of law: varieties of knowledge in biotechnologies regulation. Minerva, 55, pp.209-228.
Objective of the document	The paper addresses the question of adaptation of existing regulatory frameworks in the face of innovation in biotechnologies, and specifically the roles played in this by various expert knowledge practices.
Territorial coverage	The geographical area is not defined.
Methodology	Case study
Themes	Effective expert knowledge practices
Main findings	In the EU-regulation on GMOs (EC 2001/18), an important role is given to the European Food and Safety Authority (EFSA) who are assigned to perform an environmental risk analysis on which licensing can either be granted or not. In terms of legitimacy, involving experts is seen in a legal perspective to bring in a substantive justification of legal decisions as experts are taken to 'know more' about the subject than the lawmaker. Their robust knowledge is seen to be able to legitimate decisions. Furthermore, societally validated experts may be seen to bring in an element of neutrality, refrain from normative judgments and build their claims on facts, observation and rational arguments. In other words, experts can be accorded and claim a high level of accountability. From the legal perspective, scientific experts play an important role in bringing in knowledge that the legislator lacks or is lacking in general. However, non-scientific types of knowledge such as legal knowledge and what might simply be called 'societal knowledge' may be important parts of 'regulatory knowledge' broadly defined, in any given sector or instances of novel technology.
Specific elements on group decision-making	A range of knowledges are instrumental in the negotiation and adaptation of law for innovative, challenging technologies. These include articulation of moral values, scientific facts and societal and economic consequences that may be relevant for legal decision-making (Poort, 2013) and that

	knowledge of these is such that experts can be designated to bring it into the legal process. It is argued that experts are involved when dealing with issues in which the legislator lacks knowledge. The lack of knowledge and expert consensus is also explained by the complexity of the issue at stake introducing diverse types of uncertainties.
Lessons learnt or recommendations	Scientific experts are organised or consulted for various reasons: neutrality, objectivity, either 'knowing more', or to demonstrate their representation for reasons of credibility of the regulation process. A perceived gap of knowledge, which cannot be bridged by existing regulatory frameworks and existing institutions, is of particular importance for exploring new regulatory measures, because this leaves the ground open for various types of knowledge, stakeholders' interests and their own knowledges to be deployed. This analysis teaches us that the dynamics such as debate about social and cultural desirability of new technologies, and their industrial organisation are equally important. Therefore, ethics committees and ethics representation, economic analysis and societal debate additionally may play an important role in any given innovative technological field, although it is difficult to discern any systematic pattern of relationships between the framing of expertise and the maintaining/breaking strategy chosen in any given case.

Factsheet 30

Name of the publication	Hauray B, 2017. From regulatory knowledge to regulatory decisions: the European evaluation of medicines. Minerva, 55(2), pp.187-208.
Objective of the document	Based on interviews with European regulators, but also on direct observations of several meetings of the European Medicines Agency's main expert committee, this article aims to analyse how regulatory knowledge is defined and then transformed into regulatory decisions.
Territorial coverage	European Union
Methodology	Case study
Themes	Regulatory knowledge Regulatory decision-making
Main findings	The European Medicines Agency, created in 1993, coordinates the work of the national agencies and of the two European procedures mandatory for any product that a firm wants to sell in more than one EU country. Within the EMA, the Committee for Medicinal Products for Human Use (CHMP) is responsible for preparing the Agency's opinions. CHMP members are nominated by EU Member States but are "chosen on the strength of their qualifications and expertise with regard to the evaluation of medicines." They sit in their own name and any instructions from their national licensing authorities that are in any way "incompatible with their tasks" are prohibited. Most new molecules are now evaluated through the centralized procedure. In this procedure, two CHMP members act as rapporteurs and conduct the initial evaluation of every application file. Although rapporteurs work independently and are free to choose their teams from among any EMA-recognised experts (there are more than 5,000 for the whole agency), in reality they work with their national agencies. On the basis of their reports, several deliberations take place within the Committee in order to reach a common opinion, which is ratified by a vote. This opinion is then turned into a decision by the European Commission and that decision is binding across all EU Member States.

Specific elements on group decision-making	The author argues that medicines evaluation relies not solely on the qualitative assessment of quantitative data, but it also involves many different types of knowledge: knowledge about firms' past and present strategies, about patients' needs and future behaviour, about the state of research and clinical practices, and about legal and policy-making issues.
Lessons learnt or recommendations	Reflecting on the role of drug regulators 50 years after the Thalidomide tragedy, prominent actors of European medicines regulation underlined that "benefit–harm decisions are inherently about expected utility, the product of probabilities (derived from 'objective' data) and utilities (value judgments that are necessarily subjective)" (Eichler et al., 2012). They also acknowledged that: "reports are usually silent on value judgments. This is not to imply that values and preferences do not come into regulatory decisions—they have to—but they are inserted implicitly." Even though these statements maintain the idea of a clear distinction between "objective" data and "subjective" value judgments, they do show that, in recent years, some European regulators seem to have moved away from a scientistic representation of medicines evaluation. This evolution is valuable as it reduces the gap between practice and discourse concerning the licensing of products. But it also reinforces the criticisms articulated by those who, for a long time now, have questioned the political accountability of the experts entitled to make these decisions (Abraham and Davis, 2007). In a context marked by a series of conflict-of-interest controversies, European regulators will face growing pressure to provide greater transparency on how experts handle these "implicit" preferences and "subjective" considerations during each medicine evaluation and indeed on the whole process of opinion-making.