

ANNUAL REPORT 2018



ABOUT IRGC

Since 2016, IRGC consists of two distinct and independent entities that collaborate and support each other:

- **The International Risk Governance Center** (IRGC@EPFL), a transdisciplinary centre at the Ecole polytechnique fédérale de Lausanne. More information on irgc.epfl.ch.
- **The International Risk Governance Council** Foundation. Established in 2003 at the initiative of the Swiss government, the IRGC Foundation is based at EPFL in Lausanne, Switzerland, with network partners in Europe, the US and Asia. More information on irgc.org.

Both work together and operate as a neutral convening place for identifying, discussing, evaluating and suggesting governance arrangements towards improving the governance of risk issues marked by complexity, uncertainty and ambiguity. IRGC provides insight into risks that have impacts on human health and safety, on the environment, on the economy and on society at large.

FOREWORD

In January 2018, IRGC organised its first 'strategy meeting' gathering members of its boards and scientific committees (both IRGC Foundation and IRGC@EPFL Center). The meeting confirmed IRGC's valuable contribution as a neutral platform for science-based knowledge development and sharing. IRGC's intrinsic multi-disciplinary and multi-stakeholder nature is appropriate to not only identify risks and governance challenges, but also to suggest collaborative strategies to deal with them.

IRGC will thus continue to develop its mission and activities as a convening place, on topics that deserve attention by scientists, industry, policymakers, regulators and society.

To select these topics, and thanks to the connection with EPFL's expertise, it will prioritize work on some technologies that hold promises for mitigating existing risks, and focus on those attendant (often neglected) risks that require attention. Examples include consequences of digitalisation and of advances in genomic research and precision medicine.

IRGC is problem-driven. It aims to provide or help others develop solutions, in a collaborative manner. At the same time, IRGC strives to adopt a long-term view, to identify long-term or systemic problems that are slow to materialise and may not seem catastrophic yet, do not attract sufficient attention in the public or policymaking, but could result in significant damage or loss.

This is what IRGC aims to achieve with its guidelines for the governance of systemic risks, published at the end of 2018. The guidelines acknowledge that systemic risks develop in complex adaptive systems, often in transition, and that transformation are often unavoidable.



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2018 AT A GLANCE

PUBLICATIONS

APRIL

Governance of Trust in Precision Medicine
Workshop report

JULY

The Economics of Precision Medicine
Workshop report

SEPTEMBER

Guidelines for the Governance of Systemic Risks

NOVEMBER

Resource Guide on Resilience (Volume 2)
Resource guide

NOVEMBER

The Governance of Decision-Making Algorithms
Workshop report

WORKSHOPS

30 JANUARY

IRGC Strategic Meeting
Lausanne, EPFL

12-13 APRIL

The Economics of Precision Medicine
Geneva, EPFL Campus Biotech

9-10 JULY

Governing Risks Related to Decision-Making Algorithms
Zürich, Swiss Re Institute

20-21 NOVEMBER

Systemic Risks: Bridging Gaps Between Theory and Practice
Potsdam, IASS

2018 ACTIVITIES

IRGC activities are organised into two major work areas: **development of concepts and instruments for risk governance** and **application to specific issues and recommendations for risk governance**. It fulfils its mission by organising multi-disciplinary and multi-sectoral expert workshops and by publishing peer-reviewed reports, policy briefs and concept notes that presents its analysis and risk governance recommendations. 2018 activities are described below.

CORE CONCEPTS OF RISK GOVERNANCE

IRGC continuously develops **risk governance concepts and guidelines for risk governance**, which have consistently guided stakeholders in the governance decision-making process since 2005.

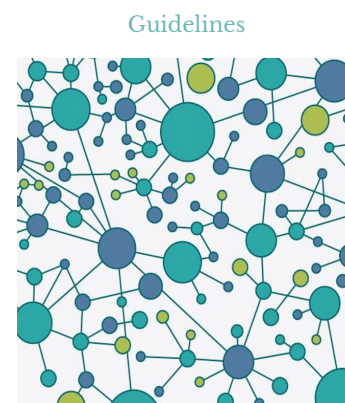
• SYSTEMIC RISKS

GUIDELINES FOR THE GOVERNANCE OF SYSTEMIC RISKS

Systemic risks are risks that manifest in complex adaptive systems. They are fundamentally different from conventional risks. Traditional risk management practices are not sufficient for dealing with them. IRGC's guidelines for the governance of systemic risks address the question of how to deal with systemic risks in the context of system transitions, i.e., in situations that require adaptation to new context conditions or transformation of an organisation or ecosystem.

The guidelines have the following **objectives**:

- Provide guidance to organisations in their initiatives to understanding complex system dynamics and reflecting upon their position within these dynamics.
- Help actors in a system to (a) prevent the shift of the system within which the organisation operates to an undesirable regime, or (b) trigger and facilitate the transition of the respective system to a preferable regime, considering changes in underlying context conditions or proximity to a tipping point that may trigger a regime shift.



IRGC (2018). *Guidelines for the Governance of Systemic Risks*

The guidelines comprise seven interlinked steps:



1. **Explore the system** in which the organisation operates; define the boundaries of the system and the organisation's position in a dynamic environment
2. **Develop scenarios**, considering ongoing and potential future transitions
3. **Determine goals** and level of tolerability for risk and uncertainty
4. **Co-develop management strategies** to deal with each scenario and the systemic risks that affect or may affect the organisation, and to navigate the transition
5. **Address unanticipated barriers** and sudden critical shifts that may come up during the process
6. **Decide, test and implement strategies**
7. **Monitor, learn from, review and adapt**

WORKSHOP: APPLYING MODELS FOR THE GOVERNANCE OF SYSTEMIC RISKS TO 'REAL-WORLD PROBLEMS'

The **objective** of the workshop was to discuss in a closed setting how to improve the relevance of concepts, theories, definitions or models for systemic risks in a way that is scientifically correct, and that makes sense and is useful to policy analysts and practitioners.

Participants discussed specifically about:

- Current theories and models developed for dealing with systemic risks;
- How developments in the discipline of risk analysis (i.e. by the risk research community) can forge relevant concepts and help to bridge science and practice;
- How to better use complexity science, systems thinking and network theory in the development, use and application of models;
- How to address challenges of resources needs and constraints;
- Moving from (incomplete) understanding to doing: what are the necessary facilitators and triggers;
- How to address institutional barriers.



20-21 November
Expert meeting

• RESILIENCE

SMARTRESILIENCE

The Horizon 2020 project SmartResilience (2016-2019) develops indicators and methods to measure the resilience of critical infrastructure. IRGC organises contribution from insurance companies to provide feedback and discuss the extent to which insurability of critical infrastructure can be improved, using the SmartResilience method for assessing their resilience in the face of disruptions.



RESOURCE GUIDE ON RESILIENCE (VOLUME 2)

In 2016, IRGC published the **first volume** of its Resource Guide on Resilience. This collection of over 40 authored pieces offers researchers and practitioners a review of concepts, definitions and approaches of resilience, with a focus on comparing, contrasting and integrating risk and resilience, and indicators and measurements.



IRGC (2016). *IRGC resource guide on resilience (vol. 1):*



IRGC (2018). *IRGC resource guide on resilience (vol. 2)*

The **second volume** of IRGC's resource guide on resilience:

- Provides an in-depth and pragmatic evaluation of concepts and methods for resilience-based approaches in contrast to risk-based approaches, as proposed and practiced in different domains of science and practice. Adequate articulation of risk and resilience is key to ensure security in systems.
- Considers possible drawbacks of resilience, such as when resilience does not discourage inappropriate risk-seeking behaviour.
- Discusses the relevance and role of resilience as a strategy to address challenges posed by systemic risks that develop in complex adaptive systems (CAS). Such systems are interconnected, with the result that risks can cascade within and between systems. Resilience can help steer dynamic changes in CAS, as those evolve in response to internal and external shocks and stresses.

VOLUME 2: CONTENTS

An Introduction to 2nd Volume of the Resource Guide on Resilience <i>Igor Linkov, Marie-Valentine Florin, Benjamin D. Trump</i>	Technological Surprise and Resilience in Military Systems <i>Alexander Kott</i>
A Janus-Faced Resource: Social capital and resilience trade-offs <i>Daniel P. Aldrich, Courtney Page-Tan and Timothy Fraser</i>	Mindfulness and the Risk-Resilience Trade-off in Organizations <i>Ravi S. Kudesia, and Jochen Reb</i>
Ecological Resilience <i>Craig R. Allen and Dirac Twidwell</i>	Resilience and Robustness in Ecological Systems <i>Simon A. Levin</i>
From Security to Resilience: New vistas for international responses to protracted crises <i>Rosanne Anholt and Kees Boersma</i>	Considerations of Resilience Management in Transportation <i>Maria Nogal and Alan O'Connor</i>
The importance of resilience-based strategies in risk analysis, and vice versa <i>Terje Aven and Shital Thekdi</i>	Resilience: Moving Forward from a Metaphor <i>José Palma-Oliveira and Benjamin D. Trump</i>
Resilience as an Integrative, Measurable Concept for Humanitarian and Development Programming <i>Christopher B. Barrett and Joanna B. Upton</i>	Resilience Assessment in Homeland Security <i>Frédéric Petit</i>
Resilience to Global Catastrophe <i>Seth D. Baum</i>	Unlocking Organizational Resilience <i>Elaine D. Pulakos and Derek Lusk</i>
Conceptualizing Risk and Unit Resilience in a Military Context <i>Colanda R. Cato, Shala N. Blue and Bridget Boyle</i>	Advances in Analyzing and Measuring Dynamic Economic Resilience <i>Adam Rose and Noah Dormady</i>
Resilience in the Context of Systemic Risks: Perspectives from IRGC's Guidelines for the Governance of Systemic Risks <i>Marie-Valentine Florin and Benjamin D. Trump</i>	The Case for Systemic Resilience: Urban communities in natural disasters <i>Božidar Stojadinović</i>
Resilience Analysis of Urban Critical Infrastructure: A human-centred view of resilience <i>Kazuo Furuta and Taro Kanno</i>	Resilience of Critical Infrastructure Systems: Policy, research projects and tools <i>Marianthi Theocharidou, Luca Galbusera and Georgios Giannopoulos</i>
Robustness and Reconfigurability – Key concepts to build resilience <i>Hans Rudolf Heinemann</i>	Resilience Analytics by Separation of Enterprise Schedules: Applications to infrastructure <i>Heimir Thorisson and James H. Lambert</i>
Resilience of Systems to Individual Risk and Systemic Risk <i>Stefan Hochrainer-Stigler, Gergely Boza, Célian Colon, Sebastian Poledna, Elena Rovenskay, and Ulf Dieckmann</i>	Resilience is a Verb <i>David D. Woods</i>
	Managing Energy Transition Through Dynamic Resilience <i>Martin Young and Angela Wilkinson</i>

SPECIFIC ISSUES

IRGC selects some specific **issues where the application of its concepts for risk governance could help improve opportunity and risk management**. Selection criteria include that deficits or deficiencies in existing governance structures and processes hinder the development of promising technologies, and that an interdisciplinary and multi-stakeholder approach is needed to overcome those deficits.

• PRECISION MEDICINE

GOVERNANCE OF TRUST IN PRECISION MEDICINE

Workshop report



IRGC (2018). *Governance of trust in precision medicine*.

In November 2017, IRGC organised a two-day expert meeting on the subject of Trust and Precision Medicine. Following this meeting, IRGC published a workshop report to summarise the main findings and recommendations. Participants discussed about the concept of trust and conditions of trustworthiness with respect to three essential components of the precision medicine value chain: data collection, data analysis and provision of medical care. The report provides recommendations for strategies that earn and provide evidence of trustworthiness, and sustain public trust around precision medicine, including communication, transparency and ways to assess trust.

The workshop was organised with the support of the Swiss Personalized Health Network (SPHN) and the Swiss State Secretariat for Education, Research and Innovation (SERI).

THE ECONOMICS OF PRECISION MEDICINE

In April 2018, IRGC invited twenty stakeholders from academia, insurance and pharmaceutical companies, regulation and patient groups to discuss issues of cost-effectiveness, affordability, value and innovative payment schemes in precision medicine. Precision medicine is fundamentally patient-centric, facilitating better targeted and personalised medical care, but it must also make economic sense for society. At a time when healthcare systems around the world are pressed to make better use of scarce resources and maximise health benefits, precision medicine's salience augments in view of its potential to bring about improved health outcomes in ways that are affordable, economically viable and reflect social preferences.

It is worth highlighting that different types of precision medicines may involve different economic considerations and social judgments, and that further research is needed. The workshop was organised with support of the Swiss State Secretariat for Education, Research and Innovation (SERI).

Workshop report



IRGC (2018). *The Economics of Precision Medicine. A Risk-Governance Perspective*

IRGC will continue to address this topic, focusing on creating value in health and precision medicine with a workshop at the Brocher Foundation in Geneva, in December 2019.

• DIGITALISATION

THE GOVERNANCE OF DECISION-MAKING ALGORITHMS

Societies are becoming increasingly dependent on digital technologies, including decision-making algorithms applied across a broad spectrum of sectors such as transportation and automated driving, health and medical diagnostics, public administration and criminal justice, insurance, commerce, news, advertising or autonomous weapons. As decision-making algorithms become more widespread and capable of processing large bodies of information both at scale and speed, and optimising choices for humans and institutions, they can bring wide crosscutting benefits to society. Yet they are also increasingly complex, not free from errors and possibly biased. They remain challenging to conventional decision-making where human judgment and ethical deliberation matter.

Workshop report



IRGC (2018). *The Governance of Decision-Making Algorithms.*

In July 2018, with support from the Swiss Re Institute, IRGC organised a multi-disciplinary and multi-stakeholder workshop on the governance of decision-making algorithms. In a round-table setting, a group of thirty scientists, developers in AI and data science, experts in regulatory issues and policy analysis, representatives of industry and insurance companies discussed governing risks and benefits, both at technical and governance levels.

The report elaborated after the workshop emphasizes the main opportunities and challenges related to the development and use of decision-making learning algorithms (DMLAs):

1. Technology and governance are tightly connected.
2. What is new: algorithms can 'learn' and self-evolve
3. Risk evaluation and governance must be done for each domain and applications (e.g. healthcare, automated driving, predictive policy-making, insurance, etc.)
4. Governance of DMLAs must consider existing regulations and key benchmarks, against which DMLAs' performance must be calibrated
5. It is critically important to improve the accuracy of outcome, compared to human decision
6. The problem of algorithmic biases is a key challenge, in particular when it leads to outcome with unfair social consequences
7. Under some circumstances humans should remain in control. It is thus important to differentiate if and when humans are or must be in control, and when they are unable to take control back
8. There is a need to develop standards, principles and governance rules and embed them into the very design and functioning of DMLAs
9. Defining accountability, responsibility and liability remain central
10. Engineering digital trust and developing social trustworthiness is a critical challenge and increasingly relevant

IRGC will continue to address this topic in 2019, focusing on governing risks from digital fakery.

COMMUNICATION, OUTREACH, IMPACT

WEBSITES

IRGC publications are available on both <https://irgc.epfl.ch> and www.irgc.org. Compared to 2017, the number of “page views” remain stable (5000 and 60'000 respectively).

NEWSLETTER

As of January 2019, IRGC's newsletter has 4341 subscribers. The three newsletters sent in 2018 primarily aimed to inform about latest publications. IRGC does not currently use its newsletter to communicate about facts or events without such communication being part of a research project.

On average across all 2018 campaigns combined, the largest readership is found in Switzerland, followed by the US, France, Germany and the UK.

CITATIONS

IRGC's publications are widely cited in academic publications. Google Scholar search indicated that IRGC's publications were referenced 250 times in 2018.

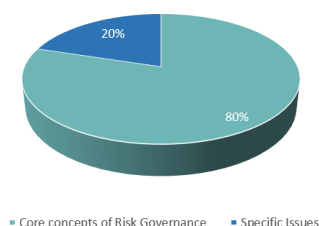
250

Academic citations of IRGC publications in 2018

Source: Google Scholar

(see some examples at page 9)

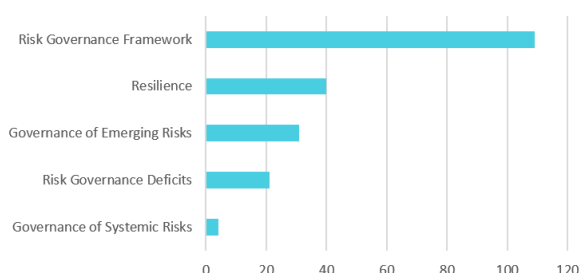
IRGC cited publications
Core Concepts vs Specific Issues



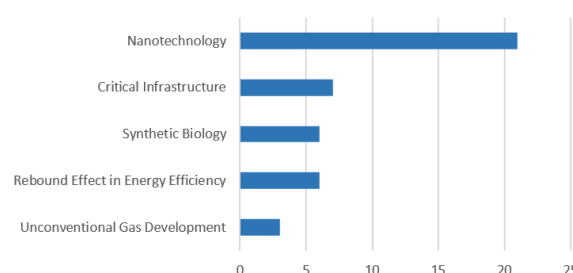
There is continuing interest in IRGC's development of core concepts and methodologies for Risk Governance, in particular the **Risk Governance Framework**, **Resilience** Volume 1 and 2 and **Guidelines for the Governance of Emerging Risks**.

Citations of IRGC's publications in 2018:

Core Concepts of Risk Governance
Top 5



Specific Issues
Top 5



SOME EXAMPLES OF HOW AUTHORS CITE IRGC

IRGC publications are cited across many issues and research domains, and in various languages (incl. Arabic, Bulgarian, Chinese, English, French, German, Japanese, Romanian, Russian, Spanish).

Most of the following papers cite one or several IRGC publications related to our concepts and approaches to risk governance.

Bowmeester M. et al (2018) **Post-marketing surveillance of chemicals: organisations and databases. Workshop report.** Rijksinstituut voor Volksgezondheid en Milieu RIVM. <https://doi.org/10.21945/RIVM-2017-0184> - "This presentation addressed a methodology for identifying new or emerging risks of chemicals (NERCs) of non-food products for consumers. In this methodology NERCs are identified according to the definition of the International Risk Governance Council (IRGC): "a new risk or a familiar risk that becomes apparent in new or unfamiliar conditions".

Brocal, F., González, C., & Sebastián, M. A. (2018). **Technique to identify and characterize new and emerging risks: A new tool for application in manufacturing processes.** Safety Science, 109, 144-156. <https://doi.org/10.1016/j.ssci.2018.05.005>

Clahsen, S. C. S., Kamp, I. van, Hakkert, B. C., Vermeire, T. G., Piersma, A. H., & Lebre, E. (2019). **Why Do Countries Regulate Environmental Health Risks Differently? A Theoretical Perspective.** Risk Analysis, 39(2), 439-461. <https://doi.org/10.1111/risa.13165>

Donohoe, T., Garnett, K., Lansink, A. O., Afonso, A., & Noteborn, H. (2018). **Emerging risks identification on food and feed – EFSA.** EFSA Journal, 16(7), e05359. <https://doi.org/10.2903/j.efsa.2018.5359> - "Innovative about IRGC guidelines for emerging risk governance, is that issues/risks are no longer addressed solely from a technological point of view: there is also attention for the way in which actors and stakeholders think about risks and the reasons they put forward for accepting or not accepting emerging risks. It is important to recognise that, due to the levels of uncertainty associated with emerging issues an iterative approach is needed."

Fragouli, E., & Seidu, S. (2018). **The Impact of Corporate Social Responsibility on Strategic Management of Reputation Risk: The Case of the Petroleum Industry.** IJAMEE, 0(0). Retrieved from <http://www.ijamee.info/index.php/IJAMEE/article/view/53> - "Contrary to use of specific risk management strategy by financial institutions and insurance companies, reputation risk management in the petroleum industry involves a holistic approach across the entire company. In the petroleum industry, the risk governance framework developed by the International Risk Governance Council (IRGC) is always the guiding principle upon which every risk management process, including reputation risk points at."

Frieling, M. & Warren, K. (2018) **Discussion Paper 18/05: Resilience and Future Wellbeing.** New Zealand Treasury. Retrieved from <https://treasury.govt.nz/publications/dp/dp-18-05> - "The Identification of Risk and Resilience factors in this paper in Chapters 3 to 6, albeit only a starting point, can inform a long-term policy agenda that supports intergenerational wellbeing. Subsequent steps may include the classification of risks by likelihood and impact, to avoid excessive focus on high-profile risks, to the neglect of higher probability but lower profile risks (IRGC, 2017). The aim of the identified factors is to encourage further thinking and discussion about how to strengthen risk management and resilience building through public policy."

Fisher, L. (2018). **Global challenges: personal reflections on the Stockholm.** "New Shape" competition. Global Challenges, 19.

Goble, R., Bier, V., & Renn, O. (2018). **Two Types of Vigilance Are Essential to Effective Hazard Management: Maintaining Both Together Is Difficult.** Risk Analysis, 38(9), 1795-1801. <https://doi.org/10.1111/risa.13003>

- Graven, C. et al (2018). **Estimation of the socio-economic consequences of regulatory measures on toxic substances in food: A proposed framework: SEATS**. Rijksinstituut voor Volksgezondheid en Milieu RIVM. Retrieved from <https://rivm.openrepository.com/handle/10029/621506> - "The risk governance framework of the International Risk Governance Council (IRGC) provides valuable input that could be applied in current SEA guidance to address ambiguity and uncertainty about risks in/to society. Insights provided by the risk governance framework were used to develop an SEA fit for the area of chemical food safety."
- Hartmann, J., van der Aa, M., Wuijts, S., de Roda Husman, A. M., & van der Hoek, J. P. (2018). **Risk governance of potential emerging risks to drinking water quality: Analysing current practices**. *Environmental Science & Policy*, 84, 97-104. <https://doi.org/10.1016/j.envsci.2018.02.015> - "The IRGC framework with a few modifications was found to be a valuable instrument for identifying areas for improvement in current risk governance approaches for emerging contaminants to drinking water quality. A key area for improvement was found to be the timely identification of and subsequent communication on emerging contaminants in drinking water."
- Jansen, T. , Claassen, L. , van Poll, R. , van Kamp, I. and Timmermans, D. R. (2018), **Breaking Down Uncertain Risks for Risk Communication: A Conceptual Review of the Environmental Health Literature**. *Risk, Hazards & Crisis in Public Policy*, 9: 4-38. <https://doi.org/10.1002/rhc3.12128>
- Klinke, A. and Renn, O. (2018) **Distributed Responsibility in Risk Governance**. In: P.A. Wilderer; O. Renn; M. Grambow; M. Molls and K. Mainzer (Eds.): *Sustainable Risk Management*. Heidelberg, Springer, pp. 19-32
- Kuzma, J., Gould, F., Brown, Z., Collins, J., Delborne, J., Frow, E., ... Stauffer, S. (2018). **A roadmap for gene drives: using institutional analysis and development to frame research needs and governance in a systems context**. *Journal of Responsible Innovation*, 5(sup1), S13-S39. <https://doi.org/10.1080/23299460.2017.1410344> - "The International Risk Governance Council argues that with emerging technologies, such as gene drives, procedural criteria become as important as substantial criteria for evaluation of risk governance (IRGC, 2015) as it is too difficult to predict outcomes prior to release and therefore the process becomes important for legitimacy."
- Linkov, I., Trump, B. D., Poinssatte-Jones, K., Love, P., Hynes, W., & Ramos, G. (2018). **Resilience at OECD: Current State and Future Directions**. *IEEE Engineering Management Review*, 46(4), 128-135. <https://doi.org/10.1109/EMR.2018.2878006>
- Linkov, I., ... Florin, M-V. (2018). **Comparative, collaborative, and integrative risk governance for emerging technologies**. *Environment Systems and Decisions*, 38(2), 170-176. <https://doi.org/10.1007/s10669-018-9686-5>
- Linkov, I., ... Florin, M-V. (2018). **Tiered Approach to Resilience Assessment**. *Risk Analysis*, 38(9), 1772-1780. <https://doi.org/10.1111/risa.12991>
- Lucas, K., Renn, O., Jaeger, C., Yang, S. (2018) **Systemic Risks: A Homomorphic Approach on the Basis of Complexity Science**. *International journal of disaster risk science*, 9, 3, p. 292-305. <https://doi.org/10.1007/s13753-018-0185-6>
- Lempert, R., & Trujillo, H. (2018). **Deep Decarbonization as a Risk Management Challenge**. RAND Corporation. <https://doi.org/10.7249/PE303> - "We present the IRGC's Risk Governance Framework as a means of spurring discussion about the need and potential for new arrangements for effective governance of decarbonization. Rather than attempting to propose any particular prescription for action, we introduce the framework to help facilitate discussion among stakeholders about the appropriate means of decarbonization."
- Marsden, T. (2018). **The SAGE Handbook of Nature**. SAGE.
- Maynard, A. D. (2018). **Thinking Differently about Risk**. *Astrobiology*, 18(2), 244-245. <https://doi.org/10.1089/ast.2017.1774> - "One of the more rigorous emerging approaches is the risk framework developed by the International Risk Governance Council (IRGC, 2005). This draws on conventional approaches to risk that are grounded in causative relationships and evidence-based mitigation strategies. But it builds into these a recognition that effective risk approaches to complex challenges require the broad engagement of multiple stakeholders—including members of the public."

Meghani, Z., & Boëte, C. (2018). **Genetically engineered mosquitoes, Zika and other arboviruses, community engagement, costs, and patents: Ethical issues**. PLOS Neglected Tropical Diseases, 12(7), e0006501.

<https://doi.org/10.1371/journal.pntd.0006501>

Moreno, V.C., & Cozzani, V. (2018). **Integrated hazard identification within the risk management of industrial biological processes**. Safety Science, 103, 340–351. <https://doi.org/10.1016/j.ssci.2017.12.004>

Odhiambo, J. N., & Ochara, P. N. M. (2018). **Precision Health Care for Sustainable Patient Centric Solutions**. In 2018 Open Innovations Conference (OI) (p. 194–197). <https://doi.org/10.1109/OI.2018.8535905>

Renn, O., Klinke, A., & Schweizer, P.-J. (2018). **Risk Governance: Application to Urban Challenges**. International Journal of Disaster Risk Science, 9(4), 434–444. <https://doi.org/10.1007/s13753-018-0196-3>

Roig, B., Weiss, K., & Thireau, V. (2018). **Management of Emerging Public Health Issues and Risks: Multidisciplinary Approaches to the Changing Environment**. Academic Press.

Stein, V., & Wiedemann, A. (2018). **Risk Governance: Basic Rationale and Tentative Findings from the German Banking Sector**. In S. O. Idowu, C. Sitnikov, D. Simion, & C. G. Bocean (Éd.), Current Issues in Corporate Social Responsibility: An International Consideration (p. 97–110). Cham: Springer International Publishing.

https://doi.org/10.1007/978-3-319-70449-4_7 - "Good corporate governance" normatively refers to fundamental ethical principles based upon the understanding of a democratic, open, mutually committed society. In transferring that notion to risk governance, it is consequential to consider good risk governance the way the International Risk Governance Council does with respect to global political risks: "Risk Governance is the application of the principles of good governance to the identification, assessment, management, and communication of risk".

Trump, B., Cummings, C., Kuzma, J., & Linkov, I. (2018). **A decision analytic model to guide early-stage government regulatory action: Applications for synthetic biology**. Regulation & Governance, 12(1), 88–100. <https://doi.org/10.1111/rego.12142>

Trump, B. D., Florin, M.-V., Matthews, S., Douglas, S. & Linkov, I. (2018). **Governing the Use of Blockchain and Distributed Ledger Technologies: Not One-Size-Fits-All**. IEEE Engineering Management Review, 46, 56–62. <https://doi.org/10.1109/EMR.2018.2868305>

Trump, B. D., Hristozov, D., Malloy, T., & Linkov, I. (2018). **Risk associated with engineered nanomaterials: Different tools for different ways to govern**. Nano Today, 21, 9–13. <https://doi.org/10.1016/j.nantod.2018.03.002>

Shi, P. (2018). **Disaster Risk Science**. Springer. - "The International Risk Governance Council (IRGC) is the creator and promoter of disaster risk management school. IRGC is initiated by the Switzerland Government, formed by a non-profit independent organization in 2003. IRGC has proposed a risk governance framework with better

systematisms and operability. The traditional expert governance mode has put one-side emphasis on rationality of science and technology. In contrast, IRGC framework is more advanced in the sense that it also considers the cultural context factors and demographic participation decision into risk decision and governance, and attaches importance to the participation of stakeholders at the same time."

Vegt, R. G. van der. (2018). **Risk Assessment and Risk Governance of Liquefied Natural Gas Development in Gladstone**, Australia. Risk Analysis, 38(9), 1830–1846. <https://doi.org/10.1111/risa.12977> - "The structure of the risk governance framework developed by the International Risk Governance Council (IRGC) is followed in order to apply a consistent and comprehensive risk governance framework that integrates scientific, economic, social, and cultural aspects and advocates the notion of inclusive risk governance through stakeholder communication and involvement."

Wong C.M.L. (2018) **From Risk Management to Risk Governance**. In: Energy, Risk and Governance. Palgrave Macmillan, Cham

EXTERNAL EVENTS WITH IRGC CONTRIBUTION IN 2018

- 15 February - “**Uncertainty and Effects of Emerging Technologies**”, presentation to a workshop on Regulatory Scenarios for Proteins and Cell Therapies, University College London, by Prof. Kenneth Oye, visiting professor at EPFL (2018 - 2019).
- 11 Avril - “**Cyberattacks on hospitals: What are the Issues?**”, workshop at the Geneva Health Forum, Geneva, by Marie-Valentine Florin.
- 19 June - “**Communication and Governance of Emerging Technologies: The Case of Gene Drives**”, Keynote Address, Conference on Self Propagating Genetic Elements, University of Bremen, Germany, by Prof. Kenneth Oye.
- 26-29 August - “**Security and Resilience of Critical Infrastructure in the Face of Hybrid Threats**”, presentation to a NATO SRS workshop in Pärnu, Estonia, by Marie-Valentine Florin.
- 12 September - “**Insights into global food system risks and opportunities and their implications for the FSA**”, contribution to a UK Food Standard Agency workshop in London, by Marie-Valentine Florin.
- 5 October - “**On Designing and Testing Technical Safeguards for Gene Drives and Industrial Chassis**”, presentation to the EPFL School of Life Science, by Prof. Kenneth Oye.
- 9 October - “**Adaptive Risk Governance Under Uncertainty: Applications to Molecular Robotics**”, presentation, Second International Conference on Molecular Robotics, Tokyo, by Prof. Kenneth Oye.
- 5 November - “**Risk Governance**” and “**Risk and Resilience in Practice**”, International Course on Risk and Crisis Management, Geneva Centre for Security Policy, by Marie-Valentine Florin.
- 12-14 November - “**Applying Adaptive Governance to Emerging Technologies in Health**”, co-organised workshop at the Brocher Fondation, Geneva, Switzerland.

The workshop had brought together experts to discuss how ‘adaptive’ governance might be used to enable the translation of ‘gateway’ technologies into practice and to deal with the complex social and ethical issues associated with their implementation.

- 30 November - “**CRISPR Babies in China**”, Round table about the edition of human genome, EPFL, Lausanne, with Prof. Kenneth Oye and Marie-Valentine Florin.

The panel discussed:

- What was claimed and what was actually done
- Medical and ethical issues associated
- Risks and their acceptability
- Short and long-term policy implications



- 6 December - “**Trust in Precision Medicine**” and “**Governing risk from decision-making learning algorithms (DMLAs)**”, presentation to the SRA Conference in New Orleans, by Marie-Valentine Florin.

Education

IRGC@EPFL participates in the **EPFL Social Sciences and Humanities (SHS) programme** with a course on risk governance, and various executive education programmes.

FEEDBACK

GUIDELINES FOR THE GOVERNANCE OF SYSTEMIC RISKS

Core Concepts

"Congratulations on this publication! I look forward to reading it in full and I will be sure to announce it to the Resilience Alliance community."

Academia

"The report looks great and I'm impressed. It was a really very difficult task to undertake and I think you've done an excellent job in translating a lot of complexity into something accessible and useful."

International organisation

"Congratulations on your recent document – we're making good use of them here with our students."

Academia

"With the Sendai Framework recognising the imperative for systems-based thinking and approaches, have put systemic risk and systems-based approaches to the fore."

International organisation

"In reading your paper on governance of systemic risks I have been struck by similarities between your views and guidance and my conceptual approach for what we would do next. Your engagement with distributed experts and well synthesized expression of the collective insights have certainly added to my thinking. Convincing an organization of a recommended path forward is always a challenge and your work becomes an excellent lever in convincing people that it is not just my good idea. I will recommend that our work be an experiment in applying the concepts you have laid out, identifying modifications necessary for a proper fit to our scale, stakeholders, scope, missions, and the fact that we must deal with conventional disaster risk, emerging risk, and systemic risk all within the same framework."

Government

RESOURCE GUIDE ON RESILIENCE VOLUME 2

Core Concepts

THE GOVERNANCE OF DECISION-MAKING ALGORITHMS

Special Issues

IRGC WORKSHOP ON THE ECONOMICS OF PRECISION MEDICINE

Special Issues

"It was as always very insightful to work with you this year and I am looking forward to the next interactions in 2019."

Private sector

"Thank you for sending your latest publication, it is quite relevant for our current and upcoming work on Artificial Intelligence within the European Commission. In the past year governance of algorithms has become a hot topic in Brussels' policy agenda."

Public sector

"Compliment on the high-quality and sobriety of the work."

Consultant

"Many thanks for the great meeting. I have been to many meetings in the past and this is certainly among the best. The pre-reads and scoping report were absolutely useful and I also enjoyed the invited faculty."

I definitely find it useful to continue this process."

Academia

IRGC ORGANISATION

IRGC@EPFL

The International Governance Center is led by a Management Committee. An Advisory Board provides guidance and recommendations on policy, business and scientific issues related to risk governance and public policy.

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The Foundation Board provides strategic direction and oversight. The Advisory Committee comprises a number of distinguished individual members who act as advisors and ambassadors.

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international risk
governance center



The EPFL International Risk Governance Center acts as a neutral platform for dialogue about opportunities and risks related to science and technologies, with the aim of providing recommendations for their governance.

The Center continues activities of the IRGC Foundation.

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