Comparing Regulatory Responses to the Climate and Covid-19 Crises

A Social-Systems Theory-Informed Method for Inquiry

*Karin Buhmann and Jingjing Wu**

Abstract: *The climate and Covid-19 crises are both recognized as wicked problems. Scientific information on climate change has been available since the 1970s and advanced by the Intergovernmental Panel on Climate Change (IPCC). Yet, responses by the national governments remain limited. Conversely, national governments' responses to the Covid-19 health crisis, including information from the World Health Organisation (WHO), were much swifter. Understanding the causes for that difference can offer important insights for future expert information for governments, and ensuing governance responses to major crises affecting humanity and the wider ecology. This article sets out the method and theoretical framing for a research project addressing that knowledge gap. Examining national governance responses to climate change and Covid-19, the project assesses those against communication from the IPCC and WHO. We explain aspects of Niklas Luhmann's social systems theory that are of particular relevance to the inquiry, describe their application, and give examples of preliminary findings.*

Keywords: *Climate change; comparative studies; Covid-19; Intergovernmental Panel on Climate Change (IPCC); national government responses; method; scientific information; systems theory; World Health Organisation (WHO)*

1. Introduction

Climate change is recognized to be a major global crisis and wicked problem (e.g., Lazarus, 2008–2009). For decades, natural scientists have warned about the risks of extensive rises in temperatures, sea levels and changed weather patterns due to human-induced rises in greenhouse gas (GHG) emissions. Aiming to prevent dangerous human interference with the climate system, the United Nations (UN) Framework Convention on Climate Change (UNFCCC) regime goes back to 1992. Adopted in 1997 and entering into force in 2005, the Kyoto Protocol turns the objectives of the UNFCCC into individual obligations for industrialised states and economies in transition by committing them to limit and reduce GHG emissions in accordance with agreed targets. Regulation under the

* Karin Buhmann is Professor of Business & Human Rights, Department of Management, Society and Communication (MSC), Copenhagen Business School; Professor, Centerleder/Director (from 1 July 2023: part-time), Centre for Law, Sustainability & Justice (CLS&J); Syddansk Universitet/University of Southern Denmark. Email: kbu.msc@cbs.dk; karbu@sam.sdu.dk

Jingjing Wu is a Post-Doc at the Centre for Law, Sustainability & Justice (CLS&J) www.sdu.dk/clsj. Juridisk Institut/Department of Law; Syddansk Universitet/University of Southern Denmark. Email: jwu@sam.sdu.dk.

UNFCCC system in principle took a large step forward with the 2015 Paris Climate Change Agreement (UN, 2015). Yet, uptake at national governance levels remains insufficient, as regularly documented by the Intergovernmental Panel on Climate Change (IPCC), most recently in its 2023 Synthesis report (IPCC, 2023). By contrast, the Covid-19 health pandemic, also a global crisis and recognised to be a wicked problem (e.g., Angeli et al., 2021), spurred quick and intensive regulatory responses by governments around the world, as well as self-regulation with individuals and companies to reduce the spread of the virus (Kunicova, 2020), in many cases in response to government advice (e.g., Tegnell, 2023). For both climate change and the pandemic, UN bodies have played major roles for the provision of information and governance advice for nation states to adopt relevant measures. For climate change, IPCC, a scientific body established by the UN, is the key scientific body with an advisory role for policy-makers, In the case of Covid-19, the World Health Organisation (WHO), another UN organisation, provided scientific information to inform governments' actions.

Both crises have immense implications for humanity. The Covid-19 pandemic caused an estimated 7 million deaths between the 3,5 years from late 2019 to end of May 2023 (WHO website a, n.d.). More than 767 million individuals are confirmed to have been affected by the virus (WHO website a, n.d.), which in its most harmful version caused and continues to cause severe respiratory problems. At the outset of what came to be the world's first pandemic caused by a coronavirus, the lethal effects of the virus were highly visible in terms of people being severely ill, suffocating due to pneumonia, hospitalized or passing, with pressures on hospitals, cremation and funeral services, and cemeteries. These effects were easily associated with the virus when explained by medical and other experts, and news media transmitted the information in pictures and texts. Around the world, many governments responded through a range of policies, guidance and legislative governance measures that included restrictions on gatherings, movement and lockdowns of different intensity in an effort to contain the spread of the virus (Kunikova, 2020; Tengnell, 2023) until it gradually subsided during 2022, due to new less lethal strains and immunity. Prior to and in some cases in parallel with lockdowns, extensive self-regulation took place among companies and individuals to limit transmission through social distancing, work or schooling from home, etc where, possible. Medical innovation and investments for vaccines to be developed and tested to large strides forward (Florio, Pancotti and Gamba, 2023). A few countries, notably Sweden and Brazil, responded somewhat differently by not introducing lockdowns or other major measures from the central government level (Christensen et al., 2023; Hale et al., 2020). However, even those countries did introduce governance measures to seek to reduce contagion. In the case of Sweden, the government issued recommendations, which led to extensive self-regulation among citizens and companies (Tengnell, 2023). In Brazil, while the federal government adopted a 'denialist stance' (Poz et al., 2021), many state and local governments introduced measures to prevent virus transmission (ibid.).

Like Covid-19, the climate crisis threatens human well-being and survival. Adverse impacts are not just affecting humans, but the entire ecological system, including animals, plants and the wider natural environment (IPCC, 2023). Responses are also more complex than closing schools and imposing lockdowns temporarily, or inventing vaccines. The urgency for action has been noted since the IPPC's early reports (IPCC, 1990/92). The IPCC predicts a more than 50% chance that global temperature rise will reach or surpass at least 1.5 degrees C between 2021 and 2040 (IPCC, 2023). This will lead to floods, droughts, extreme weather, to mention a few effects, which may cause disease,

hunger, migration and increased death rates for children and populations at risk (IPCC, 2023). Many of these effects are already being felt. Studies claim that climate change is responsible for significant land degradation and desertification (TST, UNCCD, n.d.), an alarming loss of sources of freshwater (WWF website, n.d.), large numbers of displaced people (European Parliament, n.d.), climate-induced social and political conflicts and armed violence (Nevitt, 2019).

Despite this, the efforts under the UNFCCC regime continue to fail to generate extensive regulatory measures to cut emissions of GHG at the national level. In a 2021 article, four former UNFCCC leaders observed that the principal shortcoming in regard to curbing GHG is a failure by governments to fully implement UNFCCC treaty obligations, exacerbated by the still inadequate response of the business community (Kinley et al., 2021). They also noted that the rate of global emission growth over the 30 years from 1990 testifies to this failure, with developing countries also falling short (Kinley et al., 2021). The difference in national governance responses to the climate and Covid crises is striking, given their similar implications for humanity. This begs an exploration of causes for the difference in national government responses to the two crises, including in the deployment of diverse forms of regulation.

This article presents and explains a method to inform research to respond to this knowledge gap. The method presented is aimed at a research project planned by the authors, but may of course be deployed by others. The overall aim is to contribute to a deeper understanding of correlations between the way in which expert advice is communicated and the governance responses that it gives rise to. This may provide valuable insights for the benefit of future crisis governance. More specifically, the project will contribute to the understanding of causes for the different levels of national policy uptake of WHO and IPCC information and resulting regulatory responses to climate and Covid-19 crises. The research project will do so by identifying and assessing national governance responses from various countries in the context of the information and policy advice provided by the WHO and IPCC. The project takes a sociology-of-law perspective informed by the social systems theory developed by Niklas Luhmann, with a particular emphasis on the communicative aspects of that theory. Paying particular attention to the way in which information is communicated by international export bodies with an objective of spurring national policy or regulation or other measures to shape conduct, the project examines national governmental responses against the information given by the WHO and IPCC. Initial observations led us to suspect a correlation between the way in which an international expert body communicates its findings and advice, and the uptake and therefore level of response by the national governments. Drawing on Luhmann's systems theory, in particular the significance of binary codes and structural couplings, a pilot study tested the assumption that information by an international body is more effective in generating regulatory responses at the national level if the information is communicated in a manner that triggers the internal logic of national governments, as opposed to information that is less apt at triggering that logic. Examining responses from the Danish government against the communication from the IPCC and WHO, the pilot study confirmed the validity of the assumption, and confirmed the feasibility and relevance of a wider study. Thus, we plan to examine a larger number of countries from different regions to see if we can deduct a general tendency in the correlation between the use of system-specific deployment of binary codes by international expert bodies and national governance responses. By explaining and sharing the theoretical framing and method in here, we provide a generalized overview that enables us to apply it in subsequent studies without the

need for repeated explanation. We also enable others to apply it.

Proceeding as follows, section 2 introduces the organisational set-up of the IPCC and WHO as international scientific bodies on climate change and Covid-19. Section 3 explains the theoretical framework, opening with a brief review of literature on Climate change, Covid-19, and responses, then moving on to the communicative aspects of Luhmann's systems theory, and finally explaining the results of the pilot study on Denmark's responses. Section 4 explains the method for the planned larger study, including the role to be played by systems theory as the theoretical framing. Section 5 summarizes and concludes.

2. The organisational set-up of international scientific bodies on climate change and Covid-19

2.1 IPCC: scientific information on climate change

IPCC is the key UN body for the purpose of scientific and technical advice on climate change (UN 1992, art. 21.a.) IPCC was established by the UN Environment Programme (UNEP) and the World Meteorological Organization (WMO) in 1988. Responsible for scientific communication, IPCC collaborates with 'UN Climate Change', a secretariat tasked with supporting the global response to the threat of climate change (UN 1992, art. 21.a.). IPCC publishes a general, synthesis or topical report about every 2–4 years, accompanied by a 'summary for policymakers'. The 'Conference of the Parties' (COP) is the supreme decision-making body of the UNFCCC. The Paris Climate Change Accord, an international treaty on climate change, was adopted by 196 Parties at the UN Climate Change Conference (COP21).

IPCC (2018) finds that the world is experiencing the consequences of 1°C of sustained global warming through more extreme weather, rising sea levels and diminishing Arctic sea ice. In 2018, IPCC cited more than 6,000 scientific references asking to set the global warming limits to 1.5 °C rather than the 2° C established in the Paris Agreement (IPCC, 2018). However, although the science predicting severe climate change has been calling for responses for decades, international and national governance uptake has been weak (Le Ravalec et al., 2022).

2.2 WHO: scientific information on the cause and effects of Covid-19

Founded in 1948, the WHO's overall objective is the attainment by all peoples of the highest possible level of health (UN 1996, art. 1). For practical purposes, core functions include monitoring public health risks, coordinating responses to health emergencies, providing technical assistance to countries and setting international health standards and guidelines. The WHO's Research for Health Department supports units across the entire organization, providing scientific information which is then applied by other units (WHO website b, n.d.).

The origins of the specific type of corona-virus, SARS-CoV-2 virus, which causes the disease commonly known as Covid-19, remains unclear. Believed to be due to a mutation in which a corona-virus in a bat passed to a human through another animal vector, the virus affects the upper respiratory tract followed by lower respiratory tract damage leading to severe pneumonia (Muralidar et al., 2020; Keni et al., 2020.)

Following the spread of the virus from China to other countries in early January 2020, WHO on 20 January 2020 began to hold regular press conferences providing updates on the virus, victims, and advice on responses from a health perspective. On 30 January 2020, WHO announced Covid-19 as a 'public health emergency of international concern'. Until late September 2020, the WHO held almost daily press conferences, relaying scientific data on the number of new infections, severity and global spread; as well as information on the virus and its mutations (WHO website c (n.d.)). On that

basis, and particularly during the first year of the pandemic, WHO issued advice to governments on how to handle the virus, protect people and reduce contagion, and prepare and safeguard public health systems against being overwhelmed. From October 2020, press-conferences were gradually reduced, first held bi-weekly and eventually during 2022 subsiding in favour of weekly general updates on global health issues (WHO website d, n.d.).

3. Theoretical framework

3.1 Setting the stage: Climate change, Covid-19, and responses

Scientist warned about human-induced climate change already in the 1960s (American Institute of Physics, n.d.; International Science Council, n.d.). A meeting between environmental and other scholars in 1985 with three international organisations (UNEP, the World Meteorological Organisation (WMO) and the International Council for Science (ICSU)) sparked a sense of urgency that led to the creation of IPCC (Agrawala, 1998; International Science Council, n.d.). Climate change science has gradually spread from the natural sciences like physics, meteorology, oceanography, glaciology and biology into the social sciences and other fields, evidenced e.g. by Rockström et al.'s interdisciplinary discussion of 'planetary boundaries' (Rockström et al., 2009a), widely cited in journals representing several social science sub-disciplines as well as technical, environmental and other natural sciences (Springer Nature, n.d.) While many agree that societal, including governance, responses to the warnings of natural scientists and the IPCC are inadequate (IPCC, 2023; IPCC, 2018), explanations are limited and tend to turn around the difficulty for societies to grasp the magnitude of the ecological change involved (e.g., Owen, 2020; Choi & Leckie, 2018; Clark, 2015).

The Covid-19 pandemic caught the interest of medical and public health scientists, who explored the origins of the virus, its pathology as well as public health strategies for constraining its spread in societies (Yazdanpanah et al. 2021; Harapan et al., 2020). Social scientist stated studying societal impacts and government responses (e.g., Zuber et al., 2022; Christensen et al., 2023; Hale et al., 2020), including studies of determinants, such as national identity, for public support and compliance with governmental measures (Jørgensen et al., 2021; Van Bavel et al., 2022).

The contrast in regulatory responses to climate change and Covid-19 has drawn some attention in the social science literature (e.g. Cooper et al., 2022; Ven, H.v.d. & Sun, Y, 2021; Klenert et al., 2020). The variety in responses has been explained by perceptions of the risks imposed by Covid-19 compared to climate change (Patel & Dickson, 2022), including a 'crisis' perception of Covid-19, whereas climate change is considered as a 'permanent risk' that does not require extraordinary intervention (Ruiu et al., 2020). It has also been argued that public perceptions and understanding of urgency are better advanced by a multiplicity of opinions from different fields (e.g. policymakers, government, experts, and the media) as was largely the case with the pandemic, and by convergence of such views (as was also the case of Covid-19) rather than divergence (which has been observed with climate change) (Ruiu et al., 2020).

A few scholars have proposed a systems-thinking perspective to recognize Covid-19 and other major social or global health challenges and place such problems into the wider societal context (Morgan, 2022; McConnell & Patrick, 2021; Mascareño, 2023). However, the deployment of systems theory as a theoretical framing for analysing the causes for regulatory uptakes or failures in response to the climate and Covid-19 crises has been limited. Based on initial observations suggesting a correlation between national governance responses and the way in which information was communicated by WHO and IPCC, we undertook a pilot study of responses by Denmark applying a systems theory

approach based on the communicative aspects of Luhmann's social systems theory (Buhmann and Wu, forthcoming). As that analysis proved both viable and deliver findings that are novel to the overall field of understanding and comparing national responses to the two crises, we decided to expand the analysis to other countries.

3.2 The communicative aspects of social systems theory

Systems theory is an interdisciplinary field connecting principles and concepts from a range of scientific disciplines, including philosophy of science, physics, biology, sociology, law, political science and economics. Systems may be social, biological, electrical, linguistic, etc. A system may be a sub-system of a larger system, or itself host functional sub-systems.

Niklas Luhmann, who was originally trained as a lawyer (Rogowski, 2023) and later became known as a sociologist, took inspiration from biological systems theory's perception of systems as constituted by complex collections of elements in a mutually interactive relationship (Mugerauer, 2013). Luhmann turned this towards analysis of society, but unlike much other social science, Luhmann's systems theory does not focus on institutions but on functions (Nobles & Schiff, 2012, p. 293). Luhmann's theory has proven to be well suited for socio-legal contexts due to its ability to conceptualise forms of complex social organisation and interaction from the macro-level perspective rather than through individuals' direct intentions or interaction (Rehg, 1996, p. xxi).

Luhmann describes society as comprising functional sub-systems, such as the political system, the legal system, the economic system, the science system, the health system, the media system, etc. Each functional sub-system is represented by binary codes, comprising the rationality of the (sub-)system and its opposite. In essence, this corresponds to the key interest (or 'necessary requirements') (Rogowski, 2023, p. 4) of the system for its functioning, and the opposite, which may threaten its functioning and therefore survival. The political system is constituted by the binary code of power/not power or the corollary of power/opposition; law by legal/illegal corollaries like mandatory/voluntary; the economic system by profit/loss or corollaries like payment/no payment; science by true/false; the health system by sick/healthy; media by news/not news (Luhmann, 1995; Luhmann, 1993/2015; King, 1996). Based on Luhmann's approach, further functional sub-systems have been defined, e.g. the family system, defined by a logic of care as a prerequisite for the intimacy that characterizes a family (Blom & van Dijk, 2002; Rogowski, 2023, p. 3).

Social sub-systems are comprised not of human being or actions, but of communications. Communications are processes which produce meaning. Meaning materializes when the information carried by the communication is understood. Communication, therefore, is not just a speech act but the understanding which it creates, and which may cause further communication (Luhmann, 1993/2015; Luhmann, 1992; Teubner, 1993).

3.3 Communication across functional sub-systems

A system communicates within itself, through the means of its own system-specific binary code, thereby constantly reproducing itself (Luhmann, 1986). A sub-system is closed in terms of communication but cognitively open to the environment. Because of this, a sub-system can observe the environment (which is made up by other functional sub-systems) and adapt to external pressure. This occurs through structural coupling, a mechanism of irritation within a system that triggers adaptations to pressure from another (Luhmann, 1991; Rogowski 2015). This can contribute to spurring change within a sub-system based on its response to pressure from the environment. Irritants serve as external guidance on necessary adaptions for the sub-

system to survive and respond to threats to its core rationality.

Structural coupling allows a functional sub-system to select information from its environment based on meaning. Because the system digests irritation and identifies meaning as related to its own rationality, the better the irritant triggers (by 'mimicking') the binary code of the recipient system, the higher the likelihood that that system will actually select the information, digest it, and adapt (Buhmann, 2017). These communicative dynamics may be deployed strategically by a functional sub-system to induce change in another (ibid.). Thus, the system of science may exert influence on the political system through policy advice or scientific information that lends itself easily to translation into the political logic (Verschragen, 2023, pp. 85–87; Mascareño, 2023, p. 66). Because that influence in turn affects the uptake and responses by the political system, the process can have implications for governance through law, guidance, calls for self-regulation, amendments or additions to national budget laws to allow for funds for specific activities, or other measures.

To exemplify: to spur change within the political systems, the environment (e.g., the science system) should try to 'mimick' the binary code of the political system by causing irritation that activates the logic of power/opposition. For example, based on health science data it may issue information on risks of rising numbers of sick people which will need to be treated by hospitals in the public health system, a part of the government's executive arm. This may trigger a response in the political system because that system will perceive the challenge to hospitals as a potential risk to its own power: if it does not act to protect the services provided by public hospitals, it will be seen as ineffective. This may undermine it political legitimacy or status, and result in reduced votes at the next election, eventually perhaps in the government transitioning from the power-holder to opposition. Communication occurs when the political systems digests and acts upon the pressure, for example by adopting measures to reduce contagion.

The risk to governments to lose power can be enhanced if citizens feel concerned and unsafe, either because the health system appears unable to offer care to loved ones that the family cannot provide themselves (e.g., if hospitals have to deal with too many sick people or their staff are sick themselves); or because they fear getting sick (and lacking care) and perceive that to be a result of inadequate governmental decisions, e.g., in regard to limiting social contacts to spread transmission. Conversely, the political system is little likely to select information in another binary code, e.g. the science system's code of true/false.

Both IPCC and WHO have a scientific function, given their mandates. However, in line with the explanation above, this does not preclude the possibility of structural coupling between either of these systems with other systems, such as the political system.

3.4 The pilot project

A pilot project was prompted by preliminary observations that IPCC reports, including summaries for policymakers, tend to present information on climate change through the binary code of the scientific system, while WHO shared information on the pandemic through a much more extensive deployment of the binary codes of the scientific as well as the political and family systems.

The pilot project undertook an observation at two levels. The first focused on the communication of IPCC and WHO. Here, an analysis was undertaken of the IPCC's summary-for-policymakers reports since 1990, with the objective of determining what binary logics were deployed for transmitting information on climate change and the urgency of government responses. Next, a similar analysis was undertaken of transcriptions of WHO press conferences between January and March 2020 regarding Covid-19 and

advice for government responses. The second level of observation targeted the responses by the Danish government to the climate change and covid crises, as well as the binary codes deployed by the national government in its communication with its functional branches, businesses and the population.

The analysis of IPCC and WHO showed that the IPCC overwhelmingly deploys the binary code of science and that it has done so since its inception For example, in the IPCC reports, data and other findings on climate change are described with levels of 'confidence' indicated by a series of degrees from very low to very high as well as probabilities set out in percentages.[1] The pilot project found that the IPCC's use of binary logics had undergone a slight change from the 2014 report (IPCC, 2014), possibly a response to a larger number of social scientists on the expert team. In contrast, the WHO was found to deploy a wider range of binary codes, with extensive use of messages apt to trigger the logic of states' political systems through information on steps that would assist them in protecting health systems against being overwhelmed, and protect citizens against losing loved ones. The Danish government was found to respond very directly and speedily to Covid-19 with measures in line with WHO advice, whereas its response to the climate crisis and IPCC was much less direct, with actions and communication mainly attuned to the legal and international GHG trading scheme of the UNFCCC regime but few national governance initiatives until around the publication of the IPCC's 2014 report.

1. For example, the 2023 report explains: "Each finding is grounded in an evaluation of underlying evidence and agreement. The IPCC calibrated language uses five qualifiers to express a level of confidence: very low, low, medium, high and very high, and typeset in italics, for example, *medium confidence*. The following terms are used to indicate the assessed likelihood of an outcome or a result: virtually certain 99–100% probability, very likely 90–100%, likely 66–100%, more likely than not >50–100%, about as likely as not 33–66%, unlikely 0–33%, very unlikely 0–10%, exceptionally unlikely 0–1%. Additional terms (extremely likely 95–100%; more likely than not >50–100%; and extremely unlikely 0–5%) are also used when appropriate." (IPCC 2023, 3).

4. Method for the overall study

4.1 Objective, overall approach and progression

The overall project will apply similar approaches as conducted in the pilot project to a larger range of countries.

More specifically, in order to develop insights for the governance of global (or local) crises, we assess the communication style on climate change and Covid-19 as well as governance responses at the national level. By governance responses we understand a range of governance initiatives, including the launch of new policies, including recommendations for individuals or companies, and the adoption of enforceable hard law.

The analysis on communication style is informed by Luhmann's systems theory, with an emphasis on the deployment of system-specific logics in communication and the capacity of this to trigger governance responses. This will be assessed through an analysis of the deployment of systems-specific language by the IPCC and WHO in their provision of information and policy advice to national governments, and an analysis of the extent to which national governments respond in accordance with the advice provided. The extent of national responses will be assessed based on legislative initiatives focused on national or international matters and commitments, guidance texts, policy documents, national budget law amendments, legislative history and explanatory texts issued following adoption. These initiatives can be measured and their effectiveness gauged based on further analysis by expert bodies, such as the IPCC and WHO, as well as national climate or health councils, the OECD, World Bank, etc.

In addition, press conferences and press statements as well as other national information targeting citizens will be analysed to determine deployment of systems-specific language, e.g. the family logic to induce (collective) conduct show responsibility towards others. This will be complemented by interviews with press or communication officers as well as press conference speakers in order to determine any particular communication strategies to activate governments or other entities into regulatory or self-regulatory steps or other measures.

Accordingly, the first part of the overall study embodies a comprehensive analysis of IPCC and WHO information and communicative strategies to see if the preliminary observations from the pilot case are confirmed or nuanced. The second part is a series of studies of selected countries from all continents on a rolling basis. This will enable us to compare, adjust and publish findings on a rolling basis too.

4.2 Empirical body

The empirical body for the international part of our analysis comprises IPCC reports 1988–2023 with a particular emphasis on the 'summaries for policymakers', and transcriptions of WHO press conferences between January and October 2020.

For the analysis of national governance responses, we will select countries with divergent records of lockdowns and other restrictions, including those that like Brazil and Sweden introduced few formal restrictions from the top government level. For the national studies, analysis of responses on climate change and Covid-19 will be based on policy and regulatory initiatives, legislative preparatory processes and policy debates, governance measures introduced by national agencies charged with climate or public health, and transcripts of press conferences and press releases relaying decisions on policy and other governance steps to the public, companies and other stakeholders.

Interviews will be undertaken with lead members of the IPCC writing teams (tentatively 10 from the natural sciences, 10 from social or other sciences, representing IPCC writing teams 1990–2023), WHO (tentatively 10 people) and national governments, including agencies responsible for climate change and public health (tentatively 10 from each country). Interviews will be transcribed so that they can be subject to coding along with written text.

The functional systems of the media will not be explicitly examined in this project. We recognise that media played a significant role in the transmission of information on Covid-19 as well as on governance responses, and that media play a role in the transmission (or lack of transmission) on climate change. The role of media may be the subject of a follow-up analysis.

4.3 Theoretical framing and coding

The communicative aspects of Luhmann's systems theory is applied to the empirical body of scientific communication on climate change and Covid-19 at two levels: the international level, where we look at information from the IPCC and WHO, and the national level in the selected countries.

Coding will be based on the binary logics of science, health, economic, politics, law and the family/care systems. In the analysis of government responses and arguments triggering their logics, we will consider authorities' deployment of the political and legal logics, i.e. on power and legality, because the two are often considered to be complementary for the political system.

Coding and analysis of IPCC and WHO texts is a first step. Next we will code and analyse national governance responses to determine whether and how the climate change and health communication caused irritation that triggered regulatory responses with authorities or calls on companies or citizens to self-regulate; and deployment of any of the involved logics (science, health, family, economic, politics and law). Re-

sults of the analysis of national responses will be assessed against IPCC and WHO communication to assess correlation between the use of specific binary logics by the international scientific bodies and the responses at national levels.

Coding will mainly be computer-assisted through NVIVO, with a smaller number of texts also coded manually. Coding will be based on the binary logics and varieties within each logic, as well as specific terms and phrases that can be associated with any of those. The initial coding guide will also benefit from insights from the pilot study. Manual coding, which will be done on the same basis, offers opportunities for studying texts in more detail, and adjusting the NVIVO code if necessary.

Finally, we will combine the results of the analysis of correlation between IPCC information and national-level climate responses and between WHO information and national Covid-19 responses.

5. Conclusion

This main contribution of this article is to explain a method for a study aiming to understand whether and how national government's' responses to the climate and Covid-19 crises are shaped by the way in which scientific information is communicated by international scientific bodies. The objective is to contribute to an understanding of the causes for the difference in national government responses to the information provided by the IPCC and WHO. This may help provide insights for scientists as well as policymakers and regulators towards generating effective responses to the climate crisis, as well as other potential global crises. Such knowledge may also be useful for understanding how to make governments (and other societal entities) respond adequately to future crises.

The theoretical framing for the method is provided by Luhmann's systems theory, with a particular focus on the communicative aspects including deployment of binary codes and structural couplings. We take our point of departure in the initial assumption on communication regarding climate and Covid-19 by IPCC and WHO: climate science and its expression through IPCC experts has been heavily natural science based, communicated overwhelmingly in the binary code of science. While it was also strongly scientifically oriented, the WHO's provision of information on Covid-19 was communicated in a manner that was more likely to trigger the logic of policymakers to act by resonating with their willingness to exercise power (or risk losing it).

Preliminary analysis of IPCC and WHO communication and a pilot case study of responses from the Danish government confirms this initial assumption. Given that national governance responses to the two crises, and in particular to Covid-19, differ widely across countries, the overall study aims to develop nuanced insights on communication styles deploying binary logics to deliver and transmit expert knowledge, and its impact to drive action by national governments.

References

AMERICAN INSTITUTE of PHYSICS (n.d.). *Climate change in the 1970s*. Accessed 12 February 2024, https://history.aip.org/exhibits/climate-change-in-the-70s/index.html#section3.

ANGELI, F. et al. (2021) The COVID-19 wicked problem in public health ethics: conflicting evidence, or incommensurable values?. Humanities and Social Sciences Communication, 8, 161.

BLOM, T. & DIJK, L.V. (2002) A theoretical frame of reference for family systems therapy? An introduction to Luhmann's theory of social systems. Journal of Family Therapy, 21(2), 195–216.

BUHMANN, K. (2017) *Changing sustainability norms through communicative processes: the emergence of the Business & Human Rights regime as transnational law*. Edward Elgar.

BUHMANN, K., WU, J. (forthcoming). Global crisis governance in response to scientific information: comparing and understanding regulatory responses from WHO and IPCC concerning the Covid-19 and climate crises.

CHOI, T.J., LECKIE, B. (2018) Slow Causality: The Function of Narrative in an Age of Climate Change. Victorian Studies, 60(4), 565–587.

CLARK, T. (2015) *Ecocriticism on the Edge: The Anthropocene as a Threshold Concept*. Bloomsbury Academic.

CHRISTENSEN, T., JENSEN, M.D., KLUTH, M. et al. (2023) The Nordic governments' responses to the Covid-19 pandemic: A comparative study of variation in governance arrangements and regulatory instruments. Regulation & Governance (17), 658–676.

COOPER, D.H. & NAGEL, J. (2022) Lessons from the pandemic: climate change and COVID-19. International Journal of Sociology and Social Policy, 42(3/4), 332–347.

EUROPEAN PARLIAMENT (n.d.) *The concept of 'climate refugee' Towards a possible definition*, https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/698753/EPRS_BRI(2021)698753_EN.pdf.

FLORIO, M., PANCOTTI, C., & GAMBA, S. (2023) *Mapping of Long-term Public and Private Investments in the Development of Covid-19 Vaccines: Study prepared at request of the European Parliament's Policy Department for Economic, Scientific and Quality of Life Policies to support the Special Committee "COVID-19 pandemic: lessons learned and recommendations for the future" (COVI)*.

HALE, T., ANGRIST, N., KIRA, B., PETHERICK, A., PHILLIPS, T., & WEBSTER, S. (2020) *Variation in government responses to COVID-19*. Blavatnik School of Government Working Paper, University of Oxford, www.bsg.ox.ac.uk/covidtracker.

HARAPAN H, ITOH N, YUFIKA A. et al. (2020) Coronavirus disease 2019 (COVID-19): A literature review. Journal of Infection and Public Health, 13(5), 667–673.

INTERNATIONAL SCIENCE COUNCIL (n.d.) *Origins of the IPCC: How the world woke up to climate change*. https://council.science/current/blog/the-origins-of-the-ipcc-how-the-world-woke-up-to-climate-change/ (accessed 12 February 2024).

IPCC (2023) *Climate Change 2023: Synthesis Report*. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, LEE, H., & ROMERO, J. (eds.)]. IPCC, Geneva, Switzerland, pp. 35–115, doi: 10.59327/IPCC/AR6-9789291691647.

IPCC (2018) Summary for Policymakers. In *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* [MASSON-DELMOTTE, V., P. ZHAI, P., & Pörtner, H. O. et al. (eds.)]. Cambridge: CUP, 3-24, https://doi.org/10.1017/9781009157940.001.

IPCC (2014) *Climate Change 2014: Synthesis Report*. [Core Writing Team, PACHAURI, R.K., & MEYER, L.A. (eds.)]. IPCC, Geneva.

IPCC (1990/92) *Climate Change: the 1990 and 1992 IPCC Assessments: Overview and Policy Makers Summaries and 1992 Supplement*. WHO and UNEP.

JØRGENSEN, F., BOR, A., & PETERSEN, M.B. (2021) Compliance without fear: Individual-level protective behaviour during the first wave of the COVID-19 pandemic. British Journal of Health Psychology, 26, 679–696, https://doi.org/10.1111/bjhp.12519.

KENI R, ALEXANDER, A, NAYAK P.G., MUDGAL, J., NANDAKUMAR, K (2020) Covid 19: Emergence, Spread, Possible Treatments, and Global Burden. Frontiers in Public Health, 8, doi: 10.3389/fpubh.2020.00216.

KING, M. (1996) Self-Producing systems: Implications and applications of autopoiesis by John Mingers. Journal of Law and Society 23(4), 601–605.

KINLEY, R, CUTAJAR, M.Z., DE BOER, Y. & FIGUERES, C. (2021) Beyond good intentions, to urgent action: Former UNFCCC leaders take stock of thirty years of international climate change negotiations. Climate Policy, 21:5, 593–603, DOI: 10.1080/14693062.2020.1860567.

KLENERT, D., FUNKE, F., MATTAUCH, L. et al. (2020) Five Lessons from COVID-19 for Advancing Climate Change Mitigation. Environmental and Resource Economics, 76, 751–778.

LAZARUS, R. (2008/2009) Super Wicked Problems and Climate Change: Restraining the Present to Liberate the Future. 94 Cornell L. Rev. 1153.

LE RAVALEC, M., RAMBAUD, A., & BLUM, V. (2022) Taking climate change seriously: Time to credibly communicate on corporate climate performance. Ecological Economics, 200, 107542, https://doi.org/10.1016/j.ecolecon.2022.107542.

LUHMANN, N. (1995) *Social Systems*. Stanford University Press, Stanford.

LUHMANN, N. (1993/2015) *Law as a Social System*. Oxford: OUP.

LUHMANN, N. (1992) The coding of the legal system, *European Yearbook in the Sociology of Law: State, law and economy as autopoietic systems: Regulation and autonomy in a new perspective*, Milano: Guiffre Publishers: 146–186.

LUHMANN, N. (1991) Operational Closure and Structural Coupling: The Differentiation of the Legal System. Cardozo Law Review, 13(5), 1419–1441.

LUHMANN, N. (1986) The Self-reproduction of law and its limits. IN TEUBNER, G. (ed.) Dilemmas of law in the welfare state, Berlin and New York: Walter de Gruyter: 111–127.

MASCAREÑO, A. (2023) Niklas Luhmann on politics and the economy in Twenty-First century's world society, IN ROGOWSKI, R. (e.d) *The Anthem Companion to Niklas Luhmann* (Anthem Press), 55–71.

MCCONNELL, P.J. (2021) COVID-19 Pandemic – A Systems Thinking Approach. Available at SSRN: https://ssrn.com/abstract=3972869.

MORGAN, M. J. (2022) COVID-19: A systems perspective on opportunities for better health outcomes. Geographical Research, 60(4), 637–650. https://doi.org/10.1111/1745-5871.12561.

MUGERAUER, B. (2013) Maturana and Varela: From Autopoiesis to Systems Application. IN ARNOLD, D. (ed.) Traditions of Systems Theory: Major Figures and Contemporary Developments. Routledge: 158–178.

MURALIDAR, S., AMBI S.V., SEKARAN S., KRISHNAN, U.M. (2020) The emergence of COVID-19 as a global pandemic: Understanding the epidemiology, immune response and potential therapeutic targets of SARS-CoV-2. Biochimie 179, 85–100, doi: 10.1016/j.biochi.2020.09.

NOBLES, R., & SCHIFF, D. (2012) Using system theory to study legal pluralism: What could be gained?. Law & Society Review, (46)2, pp. 265–294.

NEVITT, M. P. (17 April 2019) Climate Change: Our Greatest National Security Threat?. Just Security. https://www.justsecurity.org/63673/climate-change-our-greatest-national-security-threat.

OWEN, G. (2020) What makes climate change adaptation effective? A systematic review of the literature. Global Environmental Change, 62, https://doi.org/10.1016/j.gloenvcha.2020.102071.

PATEL, R.R., & DICKSON, R.J.L. (2022) Could COVID-19 mark a turning point for global action on climate change?. Health Promotion Journal of Australia, 33(2), 320–323.

POZ, M.R.D., LEVCOVITZ, E., BAHIA, L. (2021) Brazil's fight against COVID-19. American Journal of Public Health, 111(3), 390–391.

REHG, W. (1996) Translator's introduction. In J. Habermas, *Between facts and norms: Contributions to a discourse theory of law and democracy*, translated by REHG, W., Cambridge: Polity Press/ Blackwell.

ROCKSTRÖM, J., STEFFEN, W., NOONE, K. et al. (2009a) Planetary Boundaries: Exploring the Safe Operating Space for Humanity. Nature, 461, 472–475.

RUIU, M.L., RAGNEDDA, M. and RUIU, G. (2020) Similarities and differences in managing the Covid-19 crisis and climate change crisis. Journal of Knowledge Management, 24(10), 2600.

ROGOWSKI, R. (2023) Introduction. In ROGOWSKI, R. (ed.) *The Anthem Companion to Niklas Luhmann*. Anthem Press, 1–13.

ROGOWSKI, R. (2015) Autopoesis in Law. In WRIGHT, J.D. (ed.) *International Encyclopedia of the Social & Behavioral Sciences*. Elsevier, 554–556.

SPRINGER NATURE (n.d.) Citation details for Rockström et al. (2009a) https://citations.springernature.com/item?doi=10.1038/461472a (accessed 10 February 2024).

TEGNELL, A. (2023) *Tankar efter en pandemi*. Natur & Kultur Allmänlitteratur.

TEUBNER, G. (1993) *Law as an autopoietic system*. Blackwell.

TST, UNCCD (n.d.) TST Issues Brief: Desertification, Land Degradation and Drought, https://sustainabledevelopment.un.org/content/documents/1803tstissuesdldd.pdf.

UN (2015) Paris Climate Change Agreement, contained the report of the Conference of the Parties on its twenty-first session, UN doc FCCC/CP/2015/10/Add.1.

UN (1992) United Nations Framework Convention on Climate Change (UNFCCC), UNTS 1771.

UN (1946) Constitution of the World Health Organization, adopted by 22 July 1946, with later amendments.

VAN BAVEL, J.J., CICHOCKA, A., CAPRARO, V., PETERSEN, M.B. et al. (2022) National identity predicts public health support during a global pandemic. Nature Communication 13, 517, https://doi.org/10.1038/s 41467-021-27668-9.

VEN, H.V.D., SUN, Y. (2021) Varieties of Crises: Comparing the Politics of COVID-19 and Climate Change. Global Environmental Politics, 21(1), 13–22. doi: https://doi.org/10.1162/glep_a_00590.

VERSCHRAGEN, G. (2023) Epistemic sociology: Luhmann's theory of science and knowledge. IN ROGOWSKI, R. (ed), *The Anthem Companion to Niklas Luhmann*. Anthem Press, 73–92.

WHO WEBSITE A (n.d.) *WHO Coronavirus (Covid-19) Dashboard, accessed 1 February 2024 at* https://covid19.who.int/.

WHO WEBSITE B (n.d.) *Research for health*, last accessed 2 February 2024 at https://www.who.int/our-work/science-division/research-for-health.

WHO WEBSITE C, *Coronavirus disease (COVID-19) previous press briefings – January 2020 – September 2020*, https://www.who.int/emergencies/diseases/novel-coronavirus-2019/media-resources/press-briefings/previous (last accessed 10 February 2024).

WHO WEBSITE D, list of press briefings on Coronavirus disease (COVID-19), October 2020 – December 2022, https://www.who.int/multimedia?healthtopics=b6bd35a3-cf4f-4851-8e80-85cb0068335b&multimediatypes=34888e2d–e685-4262-b1e0-b0d4b941a6df (last accessed 10 February 2024).

WORLD WILDLIFE FUND (n.d.) *Freshwater Scarcity*. https://www.worldwildlife.org/threats/water-scarcity.

YAZDANPANAH, F., GARG, A., et al. (2021) Literature Review of COVID-19, Pulmonary and Extrapulmonary Disease, The American Journal of the Medical Sciences, 361(5), 567–574.

ZUBER, A., SEBEH, Y., JARVIS, D., & BRATTON, S. (2022) Exploratory Literature Review of the Role of National Public Health Institutes in COVID-19 Response, *Emerging Infectious Diseases*, 28(13), 151–158.