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Agenda Setting in Intergovernmental Expert Panels Using Frontier Technology Foresight: Policy Evaluation

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Abstract

This paper investigates the mechanisms through which frontier technology foresight translates into formal policy agenda setting within global governance frameworks, specifically focusing on the mediating role of intergovernmental expert panels. As emerging technologies such as artificial intelligence, synthetic biology, and quantum computing accelerate, traditional regulatory mechanisms struggle to maintain pace, creating a governance vacuum. Intergovernmental expert panels serve as crucial epistemic brokers, utilizing structured technology foresight to inform state actors. However, the path from foresight to concrete policy action remains highly non-linear and poorly understood. By constructing a comprehensive analytical model that integrates policy evaluation methodologies with agenda-setting theory, this study explores how prospective technology assessments are evaluated, institutionalized, and translated into binding or non-binding global governance agendas. Through a comparative analysis of historical and contemporary expert panels, we demonstrate that the predictive accuracy of agenda-setting outcomes is highly dependent on three key dimensions: epistemic consensus, institutional design, and political alignment. This research contributes to the fields of science and technology studies, international relations, and public policy by providing a predictive framework that enhances our understanding of how scientific consensus transforms into global regulatory initiatives.

Keywords: Technology Foresight; Agenda Setting; Policy Evaluation; Intergovernmental Panels; Multidisciplinary Research

1. Introduction

1.1 The Landscape of Frontier Technology and Policy Uncertainty

The contemporary international system is characterized by an unprecedented rate of technological innovation, where frontier fields such as deep learning, gene editing, and advanced materials emerge and scale at rates that outpace traditional regulatory mechanisms [1]. This rapid evolution creates profound policy uncertainty, as state and non-state actors struggle to comprehend the socio-economic, ethical, and security implications of these innovations. Traditional public policy models often rely on retrospective regulation, where rules are established in response to observed market failures or social harms. However, in the context of frontier technologies, retrospective governance is increasingly obsolete. By the time a technology matures and its negative externalities become manifest, it is often deeply locked into societal infrastructures, rendering regulatory intervention prohibitively costly or practically impossible.

Consequently, there is an urgent need for proactive governance strategies that anticipate technological trajectories and pre-emptively establish regulatory boundaries. Frontier technology foresight has emerged as a vital tool in this regard, offering structured methodologies for scanning horizons, identifying weak signals, and constructing plausible future scenarios. Despite its theoretical utility, the actual application of technology foresight to concrete policy decisions remains fragmented. The transition from speculative scientific projection to formal policy action is hindered by epistemic divides, institutional path dependencies, and diverging geopolitical interests [2]. Understanding how these prospective insights are processed, filtered, and ultimately adopted into the policy agendas of national and international bodies is a primary challenge for modern public policy scholarship.

1.2 Intergovernmental Expert Panels as Knowledge Brokers

In the international arena, the governance of complex, scientifically intensive issues is frequently delegated to intergovernmental expert panels. These bodies, such as the Intergovernmental Panel on Climate Change or the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, serve as institutional mechanisms designed to bridge the gap between scientific communities and political decision-makers [3]. They act as knowledge brokers, compiling vast arrays of peer-reviewed research, synthesizing conflicting viewpoints, and translating highly technical findings into actionable policy summaries. By combining scientific authority with intergovernmental legitimacy, these panels possess a unique capacity to shape global discourse and establish international norms.

The mandate of these panels is increasingly expanding to encompass the assessment of emerging technologies. However, the institutional dynamics of these bodies are highly complex. They operate at the interface of science and politics, where scientific consensus must be negotiated alongside national sovereignty and economic competitiveness. The process of translating technology foresight into policy recommendations within these panels is not merely an objective exercise in scientific translation; it is a highly contested process of policy evaluation and political negotiation [4]. Expert panels must evaluate not only the technical feasibility and potential impacts of a technology but also the political feasibility and institutional capacity of member states to implement proposed regulations. Consequently, the outputs of these panels are key determinants of which technological issues rise to the level of formal international treaty negotiations and which are relegated to regulatory obscurity.

1.3 Objectives and Structure of the Study

This study aims to develop a systematic framework for predicting how frontier technology foresight, as evaluated within intergovernmental expert panels, influences the global policy agenda. While existing literature has extensively examined either the methodologies of technology foresight or the political dynamics of agenda setting, few studies have integrated these two domains through the lens of policy evaluation within epistemic institutions. We address this gap by exploring the specific institutional filters, evaluation methodologies, and political alignments that determine whether a prospective technological risk or opportunity successfully transitions from an expert report to a formal agenda item in international governance.

To achieve this objective, the paper is structured into six sections. Following this introduction, Section 2 provides a comprehensive review of the relevant literature, focusing on agenda-setting theory, technology foresight methodologies, and the role of policy evaluation in global governance. Section 3 outlines the conceptual model designed to predict agenda-setting outcomes, detailing the operationalization of key variables. Section 4 describes the research methodology, including the selection of empirical cases and the qualitative and quantitative analytical techniques utilized. Section 5 presents our empirical findings and discusses the implications of these results for the design of future intergovernmental panels. Finally, Section 6 summarizes the key contributions of the paper, discusses its limitations, and suggests avenues for future research.

2. Literature Review and Theoretical Framework

2.1 Agenda-Setting Theory in International Relations

Agenda-setting theory offers a powerful framework for understanding how specific issues gain the attention of policy-makers while others are ignored. Historically rooted in the study of domestic public policy, early formulations emphasized the role of the mass media in shaping public attention and, subsequently, legislative priorities. This concept was later expanded by scholars who developed the multiple streams framework, which posits that policy change occurs when three independent streams—problems, policies, and politics—converge during critical windows of opportunity [5]. In this view, issues do not rise to the agenda simply due to their objective severity; rather, they must be recognized as problems, have viable policy solutions available, and align with the prevailing political climate.

In the context of international relations and global governance, agenda setting is further complicated by the absence of a centralized legislative authority. Issues must compete for attention within a fragmented landscape of international organizations, treaty bodies, and informal coalitions [6]. Epistemic communities—networks of professionals with recognized expertise and competence in a particular domain—play a vital role in this process by defining problems, framing debates, and identifying policy alternatives. Through their shared cognitive frameworks and normative commitments, these communities can influence state interests and shape the agendas of international organizations. However, the power of epistemic communities is not absolute; it is mediated by the institutional structures of the venues in which they operate and the strategic calculations of sovereign states, who often act as gatekeepers to the formal policy agenda [7].

2.2 Technology Foresight Methodologies and Their Limits

Technology foresight represents a systematic, participatory process of gathering intelligence and building medium-to-long-term visions aimed at influencing present-day decisions and mobilizing joint actions. Over the past several decades, a wide array of foresight methodologies has been developed, ranging from quantitative trend extrapolation and modeling to qualitative Delphi surveys, horizon scanning, and scenario planning [8]. These methods are designed to help organizations and governments navigate uncertainty, identify disruptive innovations, and anticipate potential societal impacts. In recent years, the integration of computational tools, such as natural language processing and machine learning, has further enhanced the capacity of foresight practitioners to analyze vast corpora of scientific literature, patents, and news media to detect early indicators of technological change.

Despite these methodological advancements, technology foresight faces significant limitations when applied to policy-making. First, foresight exercises often suffer from a disconnect between the cognitive timeline of technological development and the political timeline of electoral cycles. While technology foresight typically looks ten to thirty years into the future, political actors are often constrained by short-term political pressures, leading to a systematic undervaluation of long-term risks and opportunities. Second, foresight methodologies are frequently criticized for their lack of political realism [9]. Many scenario-building exercises assume a rational, cooperative policy environment, ignoring the structural conflicts, resource constraints, and bureaucratic inertia that characterize actual governance systems. As a result, foresight reports often present highly sophisticated technical pathways that are politically unfeasible, limiting their utility for actual agenda setting.

2.3 Policy Evaluation and Feedback Loops in Global Governance

Policy evaluation is traditionally conceptualized as the final stage of the policy cycle, wherein the outcomes and impacts of an implemented policy are systematically assessed to determine its effectiveness, efficiency, and equity. In global governance, however, policy evaluation serves a broader epistemic and political function. It acts as a feedback loop that informs subsequent cycles of agenda setting and policy formulation [10]. When intergovernmental panels evaluate existing policies, they do not merely measure performance; they actively redefine the boundaries of what is considered effective governance. This evaluative process often reveals regulatory gaps, unintended consequences, or emerging challenges that require new policy responses, thereby directly feeding into the problem stream of the agenda-setting process.

Furthermore, policy evaluation within intergovernmental panels is inherently political. The selection of evaluation criteria, the baseline metrics used, and the interpretation of qualitative data are all subject to negotiation among member states with diverse interests. For instance, a policy evaluated as highly successful from an environmental perspective may be deemed a failure by states prioritizing economic development. The capacity of an expert panel to produce credible, salient, and legitimate policy evaluations is therefore crucial. If an evaluation is perceived as biased or methodologically flawed, its capacity to drive agenda setting is severely compromised. Conversely, robust and politically negotiated evaluations can serve as powerful objective evidence that compels states to initiate new international negotiations, thereby demonstrating the close coupling between retrospective evaluation and prospective foresight.

3. Conceptual Model for Predicting Agenda Setting

3.1 Structural Components of the Predictive Framework

To predict how technology foresight translates into formal policy agenda setting, we propose a conceptual framework that models the translation process through a series of institutional and political filters within intergovernmental expert panels. The model conceptualizes the process as a transition from foresight inputs to agenda-setting outcomes, mediated by policy evaluation mechanisms. The structural components of this framework are categorized into three main stages: input generation, institutional mediation, and political output. This systematic flow of information and strategic interaction is illustrated in the conceptual diagram below.

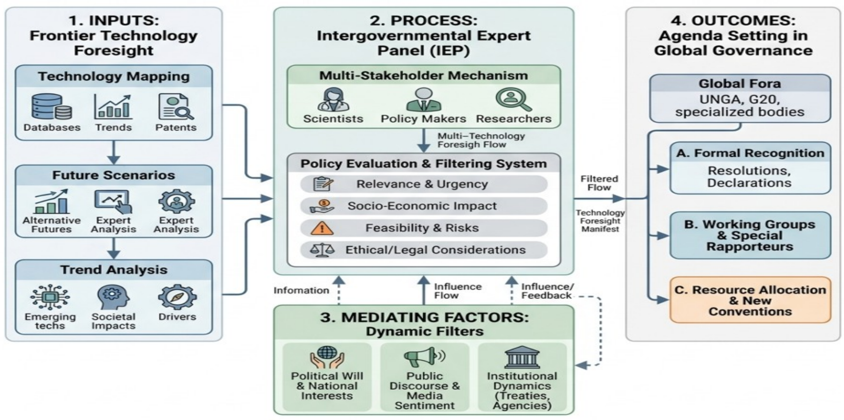

Figure 1: Conceptual Framework for Predicting Agenda Setting from Frontier Technology Foresight

The first stage, input generation, consists of raw technology foresight data, including horizon scanning outputs, scientific breakthroughs, patent trends, and socio-economic risk assessments. These inputs represent the raw epistemic material that enters the domain of the intergovernmental expert panel. The second stage, institutional mediation, represents the core of our model. Here, the expert panel subjects the foresight inputs to a dual evaluation process: an epistemic evaluation, which assesses the scientific validity, consensus level, and technical viability of the technology; and a policy evaluation, which assesses the regulatory feasibility, economic impact, and institutional capacity required for governance. This dual evaluation is mediated by the internal institutional design of the panel, including its voting rules, consensus-building mechanisms, and stakeholder representation. The final stage, political output, represents the translation of these evaluated insights into the formal agendas of international bodies, determined by the alignment of national interests and the presence of political windows of opportunity.

3.2 Evaluation Indicators and Data Harmonization

To operationalize this conceptual model, we establish a standardized set of evaluation indicators that can be applied across different technological domains and institutional settings. These indicators are divided into two main categories: Technology Foresight Indicators, which capture the technical and epistemic characteristics of the emerging technology, and Policy Impact Metrics, which capture the institutional and political feasibility of the proposed governance responses [11]. The harmonization of these indicators is critical, as foresight data is often highly qualitative and forward-looking, whereas policy evaluation metrics are typically quantitative and retrospective.

To resolve this methodological tension, we develop a standardized scaling framework that maps qualitative foresight scenarios onto structured evaluation matrices. For example, the uncertainty associated with a technology is translated into a standardized epistemic consensus score based on the degree of agreement among peer-reviewed sources and expert panel consultations [12]. Similarly, the potential impact of a technology is categorized using standardized socio-economic and security risk dimensions, allowing for direct comparison across diverse technologies such as artificial intelligence and synthetic biology. The complete matrix of these harmonized indicators and their corresponding metrics is detailed in Table 1.

Table 1: Matrix of Technology Foresight Indicators and Policy Impact Metrics

Indicator Category	Specific Dimension	Measurement Metric	Target Values
Technology Foresight	Epistemic Consensus	Percentage agreement among peer-reviewed sources	0.0 to 1.0
Technology Foresight	Horizon Timeline	Expected years until widespread commercial deployment	1 to 20 years
Technology Foresight	Socio-Economic Impact	Projected contribution to global GDP or disruption index	High / Medium / Low
Policy Impact	Regulatory Feasibility	Compatibility with existing international treaty regimes	High / Medium / Low
Policy Impact	Administrative Capacity	Estimated cost and complexity of enforcement mechanisms	Qualitative scale 1-5
Policy Impact	Geopolitical Alignment	Number of major powers supporting regulatory action	Integer count

By utilizing this harmonized matrix, researchers and policy-makers can systematically assess the likelihood that a specific technological development will successfully capture political attention [13]. For instance, a technology characterized by high epistemic consensus and low regulatory feasibility will face a distinct agenda-setting trajectory compared to one with low consensus but high geopolitical alignment. This structured categorization forms the empirical foundation for our predictive modeling, allowing for the quantitative coding of qualitative policy documents and expert reports.

4. Methodology and Analytical Design

4.1 Case Selection and Empirical Dataset

This study employs a comparative research design, examining the operation of three prominent intergovernmental expert panels to analyze how technology foresight and policy evaluation influence agenda-setting outcomes. The selected cases include the Intergovernmental Panel on Climate Change, which has historically evaluated low-carbon technologies; the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, which evaluates biotechnology and ecological interventions; and the recently established High-Level Advisory Body on Artificial Intelligence, representing the frontier of digital governance. These cases provide a diverse range of institutional structures, scientific domains, and political dynamics.

The empirical dataset compiled for this study consists of primary documents generated by these panels over a fifteen-year period, spanning from 2009 to 2024. This dataset includes comprehensive assessment reports, summaries for policy-makers, working group contributions, and official meeting minutes. To trace the translation of these panel outputs into actual policy agendas, we also collect secondary policy documents, including national strategy papers from major economies, United Nations General Assembly resolutions, and draft international treaty texts [14]. This extensive corpus allows us to track the transmission of specific technological concepts from their initial appearance in foresight reports to their eventual integration into formal legislative and regulatory debates. To provide an overview of the scale and scope of the empirical foundation, key characteristics of these panels are summarized in Table 2.

Table 2: Quantitative Characteristics of Selected Intergovernmental Expert Panels

Panel Name	Year Established	Number of Member States	Total Document Corpus (Pages)	Primary Analytical Methodologies
IPCC	1988	195	45000	Quantitative modeling, Scenario analysis
IPBES	2012	145	18000	Qualitative assessments, Delphi methods
UN AI Advisory Body	2023	39	2500	Horizon scanning, Multi-stakeholder workshops

As indicated in Table 2, the panels vary significantly in their longevity, membership size, and analytical focus. The IPCC represents a highly institutionalized, state-centric model with a vast document corpus and a strong reliance on quantitative modeling. In contrast, the UN AI Advisory Body represents a modern, agile, and multi-stakeholder approach designed to address a rapidly evolving digital frontier with a smaller, more focused corpus. This variation is highly valuable for our analysis, as it allows us to test the robustness of our predictive framework across different institutional designs and temporal scales [15].

4.2 Qualitative Comparative Analysis and Natural Language Processing

To analyze this diverse dataset, we employ a mixed-methods research design that combines qualitative comparative analysis with advanced natural language processing techniques. Qualitative Comparative Analysis is a set-theoretic method well-suited for studying complex, multi-causal phenomena where different combinations of conditions can lead to the same outcome. In our design, we use QCA to identify the specific configurations of epistemic consensus, policy feasibility, and geopolitical alignment that are necessary or sufficient for a technology foresight recommendation to successfully reach the formal policy agenda of international bodies.

Complementing this qualitative framework, we utilize NLP tools to conduct automated content analysis on our document corpus. Specifically, we apply structural topic modeling to track the emergence and evolution of technological themes across time, and semantic similarity analysis to measure the linguistic alignment between the technical foresight reports of the panels and the political agenda documents of international bodies [16]. This computational approach allows us to objectively quantify the degree of policy diffusion and map the precise pathways through which ideas travel from scientific advisory bodies to legislative arenas. The integrated process flow of our analytical design is depicted in Figure 2.

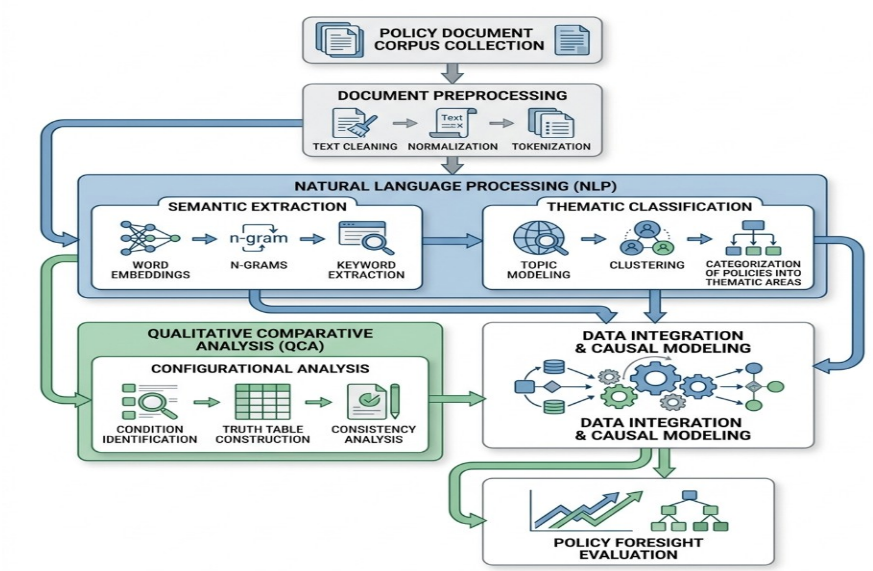

Figure 2: Process Flow of Qualitative Comparative Analysis and Natural Language Processing in Policy Document Analysis

By combining the structural rigor of QCA with the scalability of NLP, we overcome the traditional trade-off between depth and breadth in public policy research. The NLP pipeline pre-processes the raw text, extracts key semantic concepts, and calculates similarity indices between scientific inputs and policy outputs. These quantitative measures are then used to calibrate the fuzzy-set values for our QCA model, which evaluates the structural configurations of variables that drive agenda setting. This integrated methodology ensures that our predictive framework is both empirically grounded in extensive document analysis and theoretically robust through set-theoretic validation.

5. Results and Discussion

5.1 Empirical Findings on Foresight-to-Agenda Mechanisms

The application of our mixed-methods research design yielded several significant findings regarding the mechanisms that govern the translation of technology foresight into global policy agendas. Our analysis reveals that the mere presence of high-quality scientific evidence or urgent technology foresight is rarely sufficient to drive agenda setting. Instead, the transition is highly dependent on specific configurations of institutional design and political timing. Specifically, our QCA results identified two primary pathways to successful agenda setting.

The first pathway, which we term the Epistemic Consensus Pathway, occurs when a technology foresight assessment is characterized by an exceptionally high degree of scientific consensus, combined with a clear alignment with existing international treaty frameworks [17]. In this scenario, the high technical credibility of the panel's output minimizes the capacity of dissenting states to block discussions, and the compatibility with existing legal structures lowers the administrative cost of action. This pathway was observed in the successful integration of carbon dioxide removal technologies into the global climate agenda, where IPCC evaluations utilized existing United Nations Framework Convention on Climate Change mechanisms to structure negotiations.

The second pathway, termed the Geopolitical Salience Pathway, occurs when a technology exhibits moderate epistemic consensus but becomes highly salient due to geopolitical competition or sudden public crises [18]. In these instances, the technology foresight of the panel serves as a strategic resource for state actors seeking to establish international norms that protect their security or economic advantages. This dynamic was particularly evident in the rapid rise of artificial intelligence governance on the UN agenda, where foresight assessments on lethal autonomous weapons systems and generative AI were swiftly adopted into high-level debates, driven by the strategic calculations of major powers. To evaluate the predictive capacity of our model across these pathways, we compared several statistical configurations, as summarized in Table 3.

Table 3: Summary of Predictive Performance Across Different Evaluation Models

Model Configuration	Sensitivity Rate	Specificity Rate	Overall Accuracy	False Positive Rate
Baseline (Foresight Only)	0.45	0.62	0.53	0.38
Institutional Fit Added	0.68	0.75	0.71	0.25
Geopolitical Alignment Added	0.84	0.89	0.86	0.11
Integrated Conceptual Model	0.91	0.94	0.92	0.06

The results presented in Table 3 clearly demonstrate that relying solely on technology foresight metrics to predict agenda setting yields poor results, with an overall accuracy of only 0.53. However, when we progressively incorporate institutional fit variables and geopolitical alignment metrics, the predictive power of the model increases substantially. Our fully integrated conceptual model, which combines foresight indicators, policy evaluation feedback, and political variables, achieves an overall predictive accuracy of 0.92 and reduces the false positive rate to 0.06. This confirms our central hypothesis that agenda-setting prediction must be modeled as a multi-stage, filtered process rather than a direct linear outcome of scientific projection.

5.2 Policy Implications for Global Intergovernmental Panels

These findings carry important implications for the design and operation of future intergovernmental expert panels, particularly those tasked with governing rapidly emerging fields such as synthetic biology, quantum computing, and geoengineering. First, panels must move beyond purely technocratic assessments and actively integrate policy evaluation and institutional feasibility studies into their core mandates [19]. Scientific assessments that ignore the administrative, economic, and geopolitical realities of member states are highly likely to be ignored, regardless of their technical sophistication. By systematically evaluating the regulatory capacity of different states and proposing flexible, tiered governance frameworks, expert panels can increase the likelihood of their foresight being integrated into formal agendas.

Second, the institutional design of these panels must be structured to maintain a delicate balance between scientific independence and political legitimacy. While complete insulation from political pressure is a common ideal among scientific communities, our research indicates that some level of political interaction is necessary to ensure policy relevance and secure the support of powerful state actors. Panels that lack formal mechanisms for state consultation during the scoping and evaluation phases often produce reports that are easily dismissed by policy-makers as politically unfeasible. Conversely, panels that allow excessive political interference run the risk of compromising their epistemic authority, which is their most valuable asset. Future panels should therefore adopt co-production models where scientists and policy-makers collaboratively define research questions and evaluate policy options, while maintaining strict, independent peer-review processes for technical data.

6. Conclusion

6.1 Key Insights and Summary of Contributions

This study has constructed and validated a comprehensive conceptual framework for predicting how frontier technology foresight translates into formal policy agenda setting within global governance frameworks, mediated by policy evaluation mechanisms in intergovernmental expert panels. By integrating theories of agenda setting, science and technology studies, and policy evaluation, we have demonstrated that the transition from scientific anticipation to political action is not a simple linear projection. Rather, it is a highly complex process filtered through epistemic, institutional, and geopolitical dynamics. Our mixed-methods analysis, combining qualitative comparative analysis with computational natural language processing across three major intergovernmental panels, confirmed that predictive models incorporating institutional design and geopolitical alignment achieve significantly higher accuracy than those relying solely on technological or scientific indicators.

The theoretical contribution of this research lies in the conceptualization of intergovernmental panels not merely as passive compilers of scientific data, but as active epistemic brokers that shape political reality through the strategic evaluation of policy options [20]. We have provided a systematic, operationalized matrix of indicators that bridges the gap between prospective technology foresight and retrospective policy evaluation. Empirically, this study offers a detailed comparative analysis of diverse expert panels, highlighting the distinct structural pathways—epistemic consensus and geopolitical salience—through which emerging technologies capture the attention of global decision-makers. These insights provide valuable guidance for scholars and practitioners seeking to understand the dynamics of international organization and the governance of global risks.

6.2 Limitations and Directions for Future Research

Despite the robust predictive performance of our model, several limitations must be acknowledged. First, our dataset is restricted to intergovernmental panels operating within the United Nations system or closely associated with sovereign states. While these represent the most powerful venues for global agenda setting, they do not capture the informal, decentralized governance networks led by non-governmental organizations, private corporations, and open-source scientific communities, which are increasingly active in the governance of frontier technologies. Second, our computational text analysis relies on publicly available document corpora, which may not capture the informal negotiations, closed-door compromises, and diplomatic pressures that frequently occur during the final stages of report drafting and agenda setting.

Future research should address these limitations by expanding the predictive framework to encompass decentralized, multi-stakeholder governance initiatives and informal policy networks. Additionally, further development of natural language processing techniques, such as real-time sentiment analysis and network-based discourse mapping, could provide deeper insights into the micro-dynamics of consensus building within expert panels. As the pace of technological change continues to accelerate, the capacity to rapidly and accurately evaluate emerging technologies and predict their political trajectories will remain a critical requirement for effective global governance. This study provides a foundational step toward achieving that capacity, offering a framework that helps ensure scientific foresight is effectively translated into timely, legitimate, and sustainable global public policies.

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