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Science Diplomacy Initiatives and Trust Building in Regional Innovation Forums

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Abstract

This paper investigates the causal relationship between science diplomacy initiatives and trust building within regional innovation forums. As geopolitical competition increasingly fragments global research and development networks, regional innovation forums serve as critical platforms for maintaining international scientific dialogue and cooperation. However, the specific institutional designs of science diplomacy that effectively cultivate trust among diverse stakeholders remain insufficiently understood. To address this gap, we conduct a randomized survey experiment among five hundred participants recruited from prominent regional innovation forums, including policy makers, scientists, and technology entrepreneurs. Using a multi-dimensional conceptualization of trust, we examine how variations in funding mechanisms, data-sharing protocols, and governance structures affect both cognitive and affective trust. Our empirical results indicate that science diplomacy initiatives characterized by joint funding mechanisms and open-science protocols yield the most pronounced positive effects on cognitive trust. Conversely, affective trust is primarily fostered by symmetrical governance structures that guarantee equal representation of all participating nations. We also identify significant heterogeneous treatment effects based on respondents' prior levels of nationalist sentiment and pre-existing political tensions between their home countries and partner nations. These findings offer important policy insights for designing resilient regional innovation frameworks that leverage scientific collaboration to mitigate geopolitical divisions.

Keywords: Science Diplomacy; Trust Building; Survey Experiment; Regional Innovation Forums; Multidisciplinary Research

1. Introduction

1.1 Background and Context

The contemporary global landscape is characterized by a profound tension between scientific interdependence and geopolitical fragmentation. On one hand, humanity faces complex, transboundary challenges such as climate change, pandemics, and ecological degradation that imperatively require coordinated scientific responses and shared technological innovations [1]. On the other hand, the international system is witnessing a resurgence of techno-nationalism, strategic decoupling, and the securitization of scientific research, which threaten to disrupt long-standing collaborative networks [2]. In this highly polarized environment, science diplomacy has emerged as a crucial strategic instrument for maintaining communication channels, aligning national interests, and fostering international cooperation.

Science diplomacy operates at the intersection of foreign policy, scientific research, and technological innovation. It is built on the premise that scientific cooperation can serve as a non-ideological bridge between nations, facilitating dialogue even when conventional diplomatic relations are strained [3]. By mobilizing scientific communities, sharing research infrastructures, and establishing common technological standards, states can engage in constructive partnerships that transcend geopolitical rivalries. However, the efficacy of science diplomacy as a tool for conflict resolution and cooperation depends fundamentally on its capacity to

generate trust. Without mutual trust among participating actors, joint scientific endeavors are highly susceptible to concerns over intellectual property theft, espionage, unequal benefit distribution, and the weaponization of technology. Therefore, understanding the precise mechanisms through which science diplomacy initiatives build, sustain, or restore trust is of paramount theoretical and practical importance.

1.2 The Role of Regional Innovation Forums

Regional innovation forums represent key institutional arenas where science diplomacy is operationalized. These forums, which bring together policy makers, scientific researchers, industry executives, and civil society representatives, are designed to stimulate regional economic integration, foster knowledge exchange, and coordinate regional research and development agendas [4]. Examples of such platforms can be found across various geographic regions, where they act as critical nodes in the global governance of technology and innovation.

Unlike global scientific organizations, regional innovation forums are uniquely positioned to address issues of regional proximity and shared socio-economic interests. They facilitate face-to-face interactions, joint problem-solving, and the development of localized innovation ecosystems. Consequently, they serve as ideal natural laboratories for observing science diplomacy in action. Despite their potential, these forums are frequently constrained by the geopolitical dynamics of their respective regions. Disparities in scientific capacity, historical animosities, and competing national security priorities can hinder collaboration and breed suspicion among participants. The challenge for organizers and diplomats is to design regional innovation forums and associated scientific initiatives in a manner that actively mitigates these suspicions and builds a robust foundation of mutual trust.

1.3 Research Objectives and Hypotheses

Despite the growing body of literature on science diplomacy, existing scholarly work remains predominantly descriptive and qualitative. Most studies rely on historical case analyses of high-profile scientific collaborations, such as the Antarctic Treaty, the European Organization for Nuclear Research, or the Synchrotron-light for Experimental Science and Applications in the Middle East project. While valuable, these case studies often suffer from selection bias, focusing primarily on successful initiatives, and are unable to isolate the causal impacts of specific institutional designs on trust building.

This study aims to address this gap by providing systematic, experimental evidence on the causal linkages between science diplomacy initiatives and trust building within regional innovation forums. We employ a randomized survey experiment to evaluate how different configurations of scientific cooperation affect both cognitive trust, which is based on rational assessments of competence and reliability, and affective trust, which is rooted in feelings of shared identity, benevolence, and mutual respect.

Specifically, we test three main hypotheses. First, we hypothesize that joint funding mechanisms, where all participating nations contribute financially to a shared pool, will generate higher levels of cognitive trust than unilateral or asymmetric funding structures, by signaling long-term commitment and mutual investment. Second, we hypothesize that open-science protocols that mandate full data transparency and open access to research outputs will increase cognitive trust by reducing fears of hidden agendas and information asymmetry. Third, we hypothesize that symmetrical governance structures, characterized by equal representation on governing boards and shared leadership, will significantly enhance affective trust by fostering a sense of fairness, mutual respect, and shared ownership among diverse regional stakeholders.

2. Theoretical Framework and Literature Review

2.1 Science Diplomacy and International Cooperation

The conceptual foundation of science diplomacy is rooted in the recognition that scientific values and diplomatic objectives can be mutually reinforcing. Scholars have historically categorized science diplomacy into three distinct dimensions: science in diplomacy, where scientific advice informs foreign policy decisions; science for diplomacy, where scientific cooperation is used to improve relations between countries; and diplomacy for science, where diplomatic tools facilitate international scientific collaboration [5]. This study

focuses primarily on science for diplomacy, examining how the structured interactions of scientific cooperation can be strategically leveraged to build constructive diplomatic relationships.

From an international relations perspective, the theoretical basis of science diplomacy can be explained through the lenses of neoliberal institutionalism and constructivism. Neoliberal institutionalists argue that international institutions and cooperative frameworks help states overcome collective action problems by reducing transaction costs, providing high-quality information, and establishing monitoring mechanisms to prevent cheating [6]. In this view, science diplomacy initiatives act as specialized regimes that facilitate mutual gains through joint research and technological advancement. By establishing clear rules of engagement, joint patent ownership protocols, and shared research facilities, these initiatives lower the risks of collaboration and make cooperative outcomes more predictable and reliable.

Constructivist scholars, on the other hand, emphasize the role of ideas, identities, and norms in shaping international politics. They argue that scientific cooperation is not merely a rational calculation of national interests, but a social process that can transform how actors perceive themselves and others [7]. Science is characterized by a set of transnational norms, often referred to as Mertonian norms, which include universalism, communalism, disinterestedness, and organized skepticism. When scientists and policy makers engage in science diplomacy, they enter an epistemic space governed by these shared norms. This shared scientific identity can supersede nationalistic or political identities, facilitating the creation of transnational epistemic communities that advocate for cooperative policies and build bridges across political divides.

2.2 Trust in International Relations and Science Policy

Trust is a central, yet highly complex, concept in both international relations and science policy. In international relations, trust is often defined as the willingness of an actor to make themselves vulnerable to the actions of another, based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other actor [8]. Trust is critical because it reduces the need for costly verification mechanisms and enables deeper, more resilient cooperative agreements.

To understand how science diplomacy builds trust, it is essential to distinguish between its two primary dimensions: cognitive trust and affective trust. Cognitive trust, also known as calculus-based or competence-based trust, is highly rationalistic. It is built on a cognitive track record of the partner's capability, reliability, and predictability. In the context of science diplomacy, cognitive trust is established when international partners consistently deliver on scientific objectives, maintain high research standards, protect intellectual property, and adhere to agreed-upon project timelines [9].

In contrast, affective trust, also referred to as relation-based or identity-based trust, is driven by emotional bonds, perceived benevolence, and shared values. It goes beyond instrumental calculations of mutual benefit and is characterized by a belief that the partner genuinely cares about one's well-being and shares a common purpose. Affective trust is deeper and more resilient than cognitive trust; it allows cooperative relationships to withstand temporary setbacks, policy shifts, or geopolitical shocks [10]. Within regional innovation forums, affective trust is cultivated through sustained personal interactions, mutual recognition of cultural differences, and a shared commitment to addressing regional societal challenges.

2.3 Mechanisms of Trust Building through Science

The literature suggests several transmission channels through which science diplomacy initiatives can translate into trust among policy makers and scientific stakeholders. The first channel is the creation and empowerment of epistemic communities. Epistemic communities are networks of professionals with recognized expertise and competence in a particular domain and an authoritative claim to policy-relevant knowledge within that domain. Because these communities share a common scientific language, standard of validity, and commitment to objective inquiry, they can develop high levels of mutual trust internally. This internal trust can then be projected upward to the policy level as these experts advise their respective governments and advocate for science-based regional policies.

The second channel is institutionalization. When science diplomacy initiatives are formalised into stable organizations, such as joint research centers, technology transfer offices, or regional funding agencies, they create a structured environment for recurrent interactions. Institutionalization helps stabilize expectations,

provides dispute resolution mechanisms, and creates nested games where the long-term benefits of maintaining a reputation for reliability far outweigh the short-term gains of opportunistic behavior.

The third channel is the public diplomacy effect. Science diplomacy initiatives often capture public imagination, presenting a visible narrative of peaceful cooperation and shared progress. When citizens and local communities witness international scientists working together to solve pressing regional issues, such as cleaning up shared water bodies or developing regional health solutions, it can foster a broader social trust that constrains nationalistic political rhetoric and encourages political leaders to maintain cooperative diplomatic postures.

Despite these theoretical pathways, the empirical connection between science diplomacy and trust remains understudied. In particular, we know very little about how specific design features of these initiatives, such as how they are funded, how data is managed, and how decisions are made, affect the generation of cognitive versus affective trust. This study addresses this gap by isolating these design features through a randomized experimental approach.

3. Methodology and Experimental Design

3.1 Survey Experiment Design

To examine the causal impact of science diplomacy design features on trust building, we designed and implemented a randomized vignette-based survey experiment. Vignette experiments are highly effective for this type of research because they allow researchers to manipulate specific structural attributes of a scenario while holding all other contextual factors constant, thereby overcoming the endogeneity and selection biases that plague observational studies [11].

Our experiment was situated in a realistic hypothetical scenario involving the establishment of a regional innovation initiative. Respondents were asked to imagine that their home country, along with other nations in their immediate geographic region, was negotiating the creation of a new Regional Green Technology and Innovation Alliance. The primary objective of this alliance was described as developing and scaling clean energy technologies to accelerate the region's transition to a low-carbon economy.

Within this scenario, we systematically manipulated three key experimental treatments, each representing a crucial choice in the design of science diplomacy initiatives:

First, the Funding Mechanism, which had two levels:

- Unilateral/Asymmetric Funding: The initiative is primarily funded by a single dominant regional power, which provides eighty percent of the capital, while other countries contribute minimal resources.

- Shared Funding: The initiative is funded through a joint pool, where all participating nations contribute proportionally based on their economic capacity, ensuring collective financial ownership.

Second, the Data-Sharing Protocol, which had two levels:

- Restricted/Proprietary: Access to scientific data, research findings, and intellectual property developed within the alliance is restricted to contributing institutions and subject to strict commercial licensing and national security vetting.

- Open Science: All data, source code, and scientific publications produced by the alliance are made fully public and open-access under a creative commons framework, promoting regional knowledge dissemination.

Third, the Governance Structure, which had two levels:

- Unilateral/Weighted Leadership: The governing board and leadership roles are dominated by the largest participating country, with voting power weighted by financial contributions.

- Symmetrical/Joint Leadership: The governing board is structured on a one-nation, one-vote principle, with rotating co-chairmanship and equal representation for all countries, regardless of size or wealth.

The combination of these three binary factors resulted in a 2x2x2 factorial design, yielding eight distinct experimental treatment profiles. Each respondent was randomly assigned to read exactly one of these eight profiles. The randomization process was fully automated, ensuring that each participant had an equal probability of receiving any of the treatment combinations.

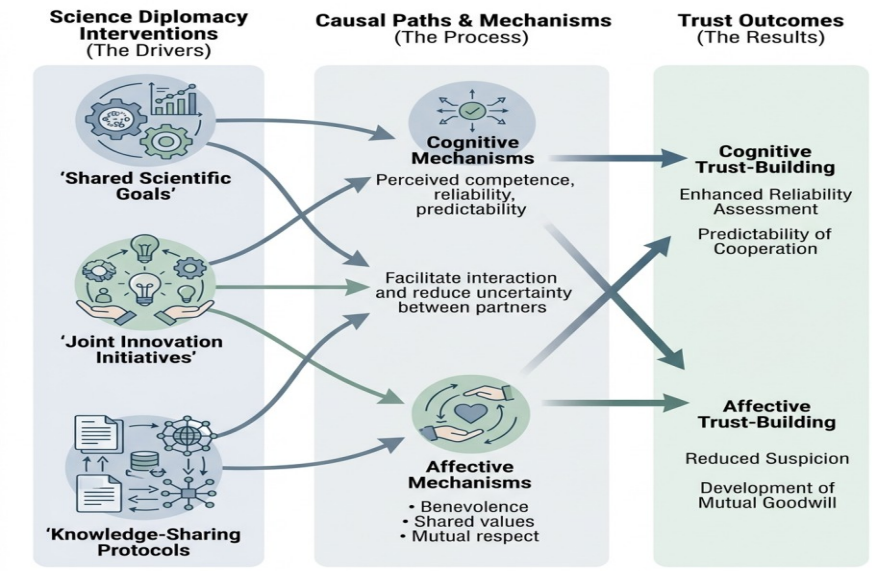

Figure 1: Causal Framework Linking Science Diplomacy Interventions to Trust Outcomes

3.2 Sample and Data Collection

The empirical data for this study were collected over a six-month period. We targeted professionals and stakeholders who actively participate in, attend, or interact with regional innovation forums. This target population is highly relevant because they are the actual agents involved in science diplomacy, making their perceptions and responses far more ecologically valid than those of general population samples.

We employed a multi-pronged recruitment strategy. First, we partnered with the secretariats of several prominent regional innovation forums to distribute the survey to their official member networks, mailing lists, and event attendees. Second, we targeted relevant professional groups on professional social networks, focusing on individuals with job titles related to science policy, international research collaboration, technology transfer, and diplomatic relations. Third, we utilized a snowball sampling technique, asking initial respondents to forward the survey to colleagues working in similar capacities within their regional networks.

A total of five hundred complete and valid responses were obtained. The sample exhibited a diverse and highly qualified demographic profile. Respondents represented over thirty countries across multiple continents, ensuring a broad geographic distribution. In terms of professional roles, approximately thirty-five percent of the sample were scientific researchers and university faculty, thirty percent were policy makers and government officials working in ministries of science, technology, or foreign affairs, twenty-five percent were industry executives and technology entrepreneurs, and ten percent represented non-governmental organizations and international scientific bodies [12].

Table 1 presents the descriptive statistics and demographic characteristics of the survey experiment sample population, demonstrating a balanced distribution across key demographic variables.

Table 1: Descriptive Statistics and Demographic Characteristics of the Survey Sample

Characteristic	Sample Percentage	Frequency	Control Group Percentage	Treatment Group Percentage
Age Under 35	34.2	171	33.5	34.9
Age 35 to 55	48.6	243	49.2	48.0
Age Over 55	17.2	86	17.3	17.1
Male	58.4	292	59.1	57.7
Female	41.6	208	40.9	42.3
Scientific Researcher	35.0	175	34.6	35.4
Policy Maker	30.0	150	29.8	30.2
Industry Representative	25.0	125	25.5	24.5
Other Professional	10.0	50	10.1	9.9
Post-Graduate Degree	82.4	412	81.9	82.9

3.3 Variables and Measurement

After reading their randomly assigned vignette, respondents were asked to complete a series of survey questions designed to measure our primary dependent variables, as well as several control variables and potential moderators. All primary outcome variables were measured using multi-item scales on a seven-point Likert scale, ranging from strongly disagree to strongly agree.

Cognitive Trust was measured using a three-item scale adapted from established organizational and international trust research [13]. The items assessed the respondent's perception of the alliance's capability and reliability, specifically focusing on: whether they believed the alliance would successfully achieve its technological goals; whether participating nations would consistently fulfill their commitments; and whether the scientific outputs produced would be of high quality and utility. The internal consistency of this scale was robust, with a Cronbach's alpha of 0.86.

Affective Trust was also measured using a three-item scale, focusing on the relational, identity-based dimensions of trust [14]. The items evaluated: whether the respondent felt the alliance created a genuine sense of regional solidarity and shared purpose; whether they believed participating countries would act benevolently and look out for each other's interests rather than merely pursuing national advantage; and whether the structure of the alliance demonstrated mutual respect for all participating cultures and systems. This scale also demonstrated high reliability, with a Cronbach's alpha of 0.88.

To validate these measures and ensure they were capturing distinct constructs, we conducted a confirmatory factor analysis. The results confirmed a clear two-factor structure, with items loading strongly on their respective theoretical constructs and exhibiting minimal cross-loadings, thereby establishing discriminant validity between cognitive and affective trust.

In addition to the main trust dimensions, we measured several potential moderating variables to explore heterogeneous treatment effects. National Identity was measured using a standard social identity scale, assessing the strength of the respondent's attachment to their nation-state. Prior Experience in International Collaboration was measured as a binary variable indicating whether the respondent had previously participated in cross-border scientific or innovation projects. Finally, we asked respondents to assess the level of geopolitical tension between their home country and other nations in their region, providing a measure of perceived Pre-existing Tension.

4. Empirical Results and Quantitative Analysis

4.1 Descriptive Statistics and Randomization Checks

Before conducting our primary causal analysis, we performed a series of balance tests and randomization checks to verify that the randomization protocol was executed successfully. If randomization was effective, the demographic characteristics of the respondents should be statistically equivalent across the different experimental treatment groups. We conducted chi-square tests for categorical variables, such as professional sector, gender, and education level, and analysis of variance for continuous variables, such as age and national identity strength.

The results of these tests revealed no statistically significant differences in respondent characteristics across the eight treatment arms. For all demographic and background variables, the p-values were well above the conventional significance threshold of 0.05, indicating that the covariates were balanced across the treatment conditions. This successful randomization ensures that any observed differences in cognitive and affective trust across the experimental groups can be confidently attributed to the manipulated features of the science diplomacy initiatives, rather than to pre-existing differences in the sample population.

4.2 Treatment Effects on Mutual Trust

To estimate the causal effects of the experimental treatments on cognitive and affective trust, we employed ordinary least squares regression analysis [15]. We estimated two main specifications. In the first specification, the dependent variable is cognitive trust. In the second specification, the dependent variable is affective trust. For both models, the independent variables are dummy variables representing the three randomized treatment dimensions: shared funding, open science, and symmetrical governance.

We report the results in terms of regression coefficients, which represent the change in the trust outcome variables on the seven-point scale resulting from the presence of a specific design feature compared to its baseline alternative. We also report robust standard errors to account for potential heteroskedasticity in the data.

Table 2 presents the estimated ordinary least squares treatment effects of the different science diplomacy configurations on both cognitive and affective trust.

Table 2: Estimated Ordinary Least Squares Treatment Effects on Cognitive and Affective Trust

Experimental Treatment	Cognitive Trust Model	Cognitive Trust Standard Error	Affective Trust Model	Affective Trust Standard Error
Intercept Baseline	3.12	0.12	2.85	0.14
Shared Funding	0.68	0.08	0.24	0.09
Open Science	0.82	0.08	0.18	0.09
Symmetrical Governance	0.35	0.09	0.94	0.08
Shared Funding x Open Science	0.22	0.11	-0.05	0.12
Shared Funding x Symmetrical	0.10	0.11	0.15	0.11
Open Science x Symmetrical	0.08	0.11	0.07	0.11

The regression results reveal distinct patterns of influence for the different design features, supporting our core hypotheses. For cognitive trust, the data-sharing protocol has the largest positive impact. Transitioning from restricted/proprietary data protocols to open-science protocols increases cognitive trust by 0.82 points on the seven-point scale, a result that is highly statistically significant with a p-value of less than 0.001. The funding mechanism also exerts a powerful effect on cognitive trust. The implementation of a shared funding mechanism, as opposed to unilateral funding, increases cognitive trust by 0.68 points, which is also statistically significant at the 0.001 level. In contrast, the governance structure has a much smaller, though still statistically significant, effect on cognitive trust, increasing it by only 0.35 points [16].

A completely different pattern emerges when we examine the determinants of affective trust. Here, the governance structure is by far the most dominant factor. Introducing a symmetrical, joint leadership structure with equal representation increases affective trust by 0.94 points on the seven-point scale, which is highly statistically significant at the 0.001 level. This finding strongly supports our third hypothesis, indicating that structural fairness and shared decision-making are essential for building deeper, relation-based trust.

Conversely, the instrumental design features have much weaker impacts on affective trust. Transitioning to a shared funding mechanism increases affective trust by only 0.24 points, and open-science protocols increase it by just 0.18 points. These coefficients, while positive, are dramatically smaller than the effect of governance, highlighting that while technical efficiency and transparency are vital for functional reliability, they are insufficient for generating emotional solidarity and mutual goodwill.

We also explored potential interaction effects between the treatment variables. The interaction between shared funding and open-science protocols is positive and statistically significant in the cognitive trust model, suggesting a synergistic effect. When a science diplomacy initiative combines both collaborative financial commitments and full information transparency, the resulting boost to cognitive trust is greater than the sum of its individual parts. However, no significant interaction effects were observed in the affective trust model, where the symmetrical governance structure remains the overwhelming driver of positive outcomes regardless of how the funding or data protocols are organized [17].

4.3 Heterogeneous Treatment Effects

To deepen our analysis, we investigated whether the treatment effects vary systematically across different subgroups of our sample. We were particularly interested in how pre-existing political tensions and the national identity strength of the respondents might moderate the impact of science diplomacy initiatives. To test this, we included interaction terms between the randomized treatments and these moderator variables in our regression models.

The analysis revealed several fascinating heterogeneous treatment effects. First, we examined the moderating role of pre-existing geopolitical tensions. We divided the sample into two groups: those who perceived low to moderate levels of tension in their region, and those who perceived high levels of tension.

For respondents in high-tension environments, the positive impact of symmetrical governance on affective trust was even more pronounced, increasing from 0.94 to 1.15 points. This suggests that when political relations are strained, the symbolic and structural equality of scientific initiatives becomes even more critical for overcoming suspicion and fostering a sense of mutual respect. Furthermore, the effect of open science on cognitive trust was also significantly stronger for individuals in high-tension settings, indicating that information transparency is highly valued as a protective mechanism when geopolitical suspicion is elevated [18].

Second, we analyzed how the respondent's strength of national identity moderated the treatment effects. For individuals with very strong national identification, unilateral funding and weighted governance structures dominated by a foreign power led to a substantial drop in both cognitive and affective trust.

However, when these nationalistic respondents were presented with the shared funding and symmetrical governance treatment, their levels of trust increased to a level comparable to those with weaker national identities. This finding suggests that symmetrical science diplomacy designs can effectively inoculate initiatives against the corrosive effects of techno-nationalism, providing a neutral framework that respects national sovereignty while facilitating meaningful regional innovation collaboration.

5. Discussion and Policy Implications

5.1 Interpretation of Findings

The empirical results of this survey experiment provide clear evidence that science diplomacy initiatives can systematically build trust among diverse stakeholders in regional innovation forums, but that the type of trust generated is highly dependent on the specific institutional design of the initiative. By separating trust into cognitive and affective dimensions, our study offers a nuanced look at the micro-foundations of international scientific cooperation [19].

Our finding that open-science protocols and shared funding mechanisms are the primary drivers of cognitive trust aligns with neoliberal institutionalist theories. These design features act as institutional commitments that reduce structural uncertainty and mitigate risk. Shared funding signals that all partners have skin in the game, creating mutual vulnerability and aligning financial incentives toward the success of the project. Open-science protocols act as a powerful transparency mechanism, eliminating information asymmetries that could lead to suspicions of intellectual property hoarding or covert military-industrial applications. When stakeholders see clear rules that guarantee transparency and mutual investment, they make a rational cognitive assessment that the partnership is reliable and low-risk.

On the other hand, the finding that affective trust is almost exclusively driven by symmetrical governance structures supports constructivist arguments about the power of recognition, fairness, and identity. Symmetrical governance, characterized by equal representation and rotating leadership, directly addresses the power dynamics that often derail regional collaborations. In many regional forums, smaller or less developed nations fear that scientific initiatives will be used as instruments of soft-power dominance by regional hegemons. Symmetrical governance structures act as a symbolic guarantee of equality and mutual respect, which is essential for transforming purely instrumental, transactional relationships into deeper, affect-based partnerships. This relational trust is crucial because it creates a reservoir of goodwill that can sustain scientific and diplomatic cooperation even when broader political relations deteriorate.

5.2 Policy Recommendations for Regional Forums

These findings have direct, practical implications for science diplomats, international organizations, and policy makers responsible for designing and managing regional innovation forums. When establishing new scientific collaborations, organizers must resist the temptation to rely on unilateral funding from wealthy patrons or to centralize decision-making in the hands of the most technologically advanced nations, even if doing so seems more efficient in the short term.

Instead, to maximize trust and build resilient partnerships, science diplomacy initiatives should be designed with structural symmetry and mutual accountability as foundational principles. First, funding models should be structured to encourage co-investment. Even if some nations can only make symbolic financial contributions, establishing a joint pool where every partner contributes proportionally is vital for cultivating a sense of collective ownership.

Second, regional forums should adopt open-science frameworks as their default operating system. While protecting sensitive national security technologies is necessary, the vast majority of environmental, public health, and basic scientific research should be kept open and transparent. Clear protocols for data sharing, open access publishing, and collaborative intellectual property management should be established at the outset of any initiative to prevent suspicions of exploitation.

Third, and perhaps most importantly, the governance of regional innovation initiatives must be structurally fair. Symmetrical representation, rotating leadership, and consensus-based decision-making models should be utilized to ensure that all participating nations, regardless of their scientific or economic capacity, have a meaningful voice in steering the regional innovation agenda. This structural respect is the key to building the affective trust that transforms scientific cooperation into a genuine bridge for diplomatic reconciliation [20].

5.3 Limitations and Future Research Directions

While this study provides valuable experimental insights, it is not without limitations. First, as with any survey-based experiment, there may be a gap between respondents' stated attitudes in a hypothetical vignette scenario and their actual behavior in real-world policy negotiations or scientific collaborations. While the use of a highly professional, expert sample mitigates this concern, future research should attempt to validate these findings using behavioral measures, such as interactive economic games or observational field studies of ongoing science diplomacy negotiations.

Second, our sample, while internationally diverse, was recruited primarily from active participants in regional innovation forums. These individuals may already possess a baseline level of internationalist orientation and a predisposition to favor scientific cooperation.

Future research should examine whether these trust-building dynamics operate similarly among more skeptical populations, such as national security officials, defense planners, or populist politicians who may view international scientific cooperation through a more zero-sum lens [21]. Additionally, future studies could explore how these mechanisms function across different regions of the world, examining whether cultural differences in trust-building, such as the relative importance of formal institutional contracts versus informal personal relationships, moderate the effectiveness of different science diplomacy designs.

In conclusion, as the global community faces an era of heightened geopolitical competition and systemic existential threats, the need for effective science diplomacy has never been more urgent. By demonstrating that thoughtful, symmetrical, and open institutional designs can causally generate both cognitive and affective trust, this study provides a empirical roadmap for using scientific innovation as a powerful tool for regional trust building and international peace.

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