

## Adapting an Organizational Culture to Stay Abreast of Technological Changes in Indonesia's Government Scientific Sector

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**Abstract:** This research navigates the disruptions the government science sector faces in an era of rapid technological change, examining the interplay of government science funding, information technology integration, and research collaboration networks. The study employs a cross-sectional design, exploring the impact of government scientific communication policies and access to advanced research technologies as independent variables, mediated by a researcher's digital literacy and skills, on the dependent variable of innovation resilience in government science. Additionally, the moderating role of government scientific infrastructure and capabilities is investigated. A comprehensive survey was administered to participants within the government science sector in Indonesia, encompassing diverse demographics and scientific disciplines. Results reveal a significant positive association between transparent government communication policies and innovation resilience, highlighting the pivotal role of effective communication in fostering adaptability. Furthermore, the study underscores the importance of government initiatives in building digital literacy and skills among researchers. The positive impact of communication policies on digital capabilities emphasizes the need for proactive strategies to enhance workforce proficiency in a technologically dynamic environment. The conceptual framework, validated through empirical findings, introduces the central construct of innovation resilience in government science, emphasizing adaptability to disruptive changes and consistent innovation.

**Keywords:** technological disruption, innovation resilience, communication policies, research technologies, digital literacy.

In the contemporary landscape of scientific inquiry, the integration of information technology has ushered in unprecedented advancements and challenges, reshaping how governments engage in scientific research (Ezzaouia & Bulchand-Gidumal, 2023). The era of rapid technological change has necessitated a critical examination of the interplay between key factors influencing government science (Campbell, 2021; Falkenberg & Fochler, 2024). The pace of technological change, particularly in information technology, has propelled scientific advancements and presented governments with a myriad of challenges (Bühler et al., 2023). As governments strive to harness the benefits of innovation, they grapple with disruptions that may impede the efficiency and effectiveness of scientific endeavors (Irani & Kilic, 2022). The

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disruption of government science encompasses various dimensions, including funding dynamics, the integration of advanced technologies, and the formation of robust research collaboration networks.

One crucial aspect influencing the disruption of government science is the formulation and implementation of communication policies (Akpan, 2018; DePaula, 2023). How scientific information is communicated, disseminated, and accessed is pivotal in shaping the research landscape (Mills & Morrish, 2023). Governments worldwide are tasked with crafting policies that balance open communication, public engagement, and safeguarding sensitive information (Sarfraz et al., 2023). This variable, government scientific communication policies, is a focal point in understanding how policy decisions impact the overall resilience of government science in the face of technological disruptions (Longnecker, 2023). In tandem with communication policies, the extent of access to advanced research technologies represents a cornerstone in the contemporary scientific landscape (Mills & Morrish, 2023). Governments must invest in and facilitate access to cutting-edge technologies to ensure that their scientific community remains at the forefront of innovation (Mahardhani, 2023). This variable explores the relationship between the availability of advanced research technologies and the potential disruptions or enhancements they introduce to government science.

This study introduces a researcher's digital literacy and skills as a mediator to delve deeper into the mechanisms through which the identified independent variables influence the disruption of government science. In the digital era, the proficiency of government researchers in navigating and leveraging digital tools is instrumental. A researcher's digital literacy and skills help to provide access to advanced research technologies and the ultimate resilience of government science (Reddy et al., 2023). At the heart of this study is innovation resilience in government science. This variable encompasses the ability of government scientific entities to adapt, innovate, and maintain a robust research environment despite the disruptions posed by rapid technological change (Liang & Li, 2023). By focusing on innovation resilience, we aim to measure the capacity of government science to weather disruptions and emerge stronger and more adaptive in the face of evolving challenges.

Additionally, acknowledging the complex web of interactions between the independent, mediator, and dependent variables, this study introduces a government scientific infrastructure and capabilities as a moderator. Leadership and management within government science agencies play a pivotal role in shaping the impact of digital literacy, communication policies, and access to technologies on the overall resilience of government science (Yang et al., 2022). This variable will help unveil how the leadership's strategic decisions and organizational capabilities moderate the relationship between the mediator and the dependent variable.

Furthermore, the current study was conducted in Indonesia. In the Indonesian context, a discernible gap exists in comprehending the nuanced dynamics of government science amid rapid technological change (Annahar et al., 2023). Despite strides in scientific research, there is a need to unravel how government policies, accessibility to advanced technologies, and the digital skills of researchers uniquely intersect (Zhang et al., 2023). By exploring the interplay between government communication policies, technological access, and digital literacy, we aim to provide tailored insights. Ultimately, our goal is to:

- Examine the impact of government scientific communication policies and access to advanced research technologies on researchers' digital literacy and skills and innovation resilience in government science;
- Examine the impact of the researchers' digital literacy and skills on innovation resilience in government science;

- Examine the mediating role of researchers' digital literacy and skills between the association of government scientific communication policies and access to advanced research technologies with innovation resilience in government science; and
- Explore the moderating influence of government scientific infrastructure and capabilities on the relationship between digital literacy and innovation resilience.

## **Theoretical Foundation and Hypothesis Development**

The theoretical foundation of this study draws upon the Innovation Resilience Framework, which integrates components from the Innovation Diffusion Theory (IDT) and the Resource-Based View (RBV). The IDT provides insights into how innovations, such as advancements in information technology, are adopted and disseminated within organizations (Yuen et al., 2021). In the context of this study, this theory is instrumental in understanding how government scientific communication policies and access to advanced research technologies are disseminated and adopted within the scientific community. The IDT framework assists in exploring the factors that influence the acceptance and utilization of innovative practices and technologies in the rapidly evolving landscape of government science. Complementing the IDT, the RBV provides a lens through which to examine how organizational resources and capabilities contribute to achieving and sustaining a competitive advantage (Kruesi & Bazelmans, 2023). In government science, funding availability, information technology integration, and robust research collaboration networks represent critical resources and capabilities (Bag et al., 2021).

The RBV framework enables us to analyze how these assets influence the overall innovation resilience of government science in the face of disruptions caused by rapid technological change (Khanra et al., 2022). The synergy between IDT and RBV in the Innovation Resilience Framework allows for exploration of the interplay between government science funding, information technology integration, and research collaboration networks. By acknowledging the diffusion of innovations and the strategic utilization of resources, the framework provides a holistic understanding of how government science can adapt, innovate, and thrive amidst the challenges posed by the era of rapid technological evolution.

## **Impact of Government Scientific Communication Policies and Access to Advanced Research Technologies on Innovation Resilience in Government Science**

Clear and transparent communication is essential for disseminating knowledge, encouraging collaboration, and navigating challenges (Thelen & Formanchuk, 2022). Previous studies emphasized the pivotal role of effective communication policies in fostering innovation resilience within organizations (Bhuiyan, 2010). Research also shows that government scientific communication policies serve as a foundation for creating a conducive environment that promotes the exchange of ideas, knowledge sharing, and proactive adaptation to technological changes (Mansoor, 2021; Medaglia et al., 2023). Effective communication policies are crucial for minimizing misunderstandings, facilitating interdisciplinary collaboration, and disseminating scientific advancements (Maulana et al., 2023). By fostering a communicative environment, government scientific communication policies are expected to influence innovation resilience positively. It is based on the fact that organizations with transparent communication structures are better equipped to adapt to disruptions, integrate new technologies, and capitalize on emerging opportunities (Mızrak, 2024).

Moreover, scholarly literature underscores the impact of technology access on innovation (Ahmad et al., 2023). In the context of government science, access to advanced research technologies is fundamental for staying at the forefront of scientific inquiry.

Technological access enables researchers to enhance their capabilities, explore novel methodologies, and address scientific challenges more efficiently (Ribeiro & Nagano, 2023). Access to advanced research technologies empowers government scientists to conduct cutting-edge research, facilitating faster experimentation, data analysis, and collaboration (Li et al., 2023). This heightened technological capability is expected to positively correlate with innovation resilience, as organizations with advanced technological infrastructure are better positioned to adapt to disruptions (DePaula, 2023), quickly integrate emerging technologies (Liang & Li, 2023), and maintain a competitive edge in the rapidly evolving landscape of government science (Ribeiro & Nagano, 2023). Therefore, the following hypotheses are posited:

**H1a:** Government scientific communication policies significantly influence innovation resilience in government science.

**H1b:** Access to advanced research technologies significantly influences the innovation resilience in government science.

### **Impact of Government Scientific Communication Policies and Access to Advanced Research Technologies on Researcher's Digital Literacy and Skills**

Effective communication policies provide guidelines for using digital tools, facilitate knowledge sharing, and contribute to developing a digitally literate and skilled workforce. If well-crafted and implemented, government scientific communication policies are expected to create an environment that encourages the development of digital literacy and skills among researchers (Fecher et al., 2023). Clear communication guidelines can facilitate information dissemination regarding digital tools, training opportunities, and best practices (Longnecker, 2023). Research in organizational communication and technology adoption suggests that organizational communication policies play a pivotal role in shaping its workforce's digital literacy and skills (Hasebrook et al., 2023). Exposure to advanced research technologies provides researchers with hands-on experience, fostering familiarity and proficiency in utilizing digital tools for scientific inquiry (Karmaker et al., 2023). Access to advanced research technologies is expected to catalyze the development of digital literacy and skills among government researchers (Tinmaz et al., 2023). Exposure to cutting-edge tools and technologies enhances their proficiency in using digital resources and stimulates a culture of continuous learning and adaptation (DePaula, 2023). Therefore, the following hypotheses are posited:

**H2a:** Government scientific communication policies significantly influence the level of digital literacy and skills among government researchers.

**H2b:** Access to advanced research technologies significantly influences the digital literacy and skills of government researchers.

### **Impact of Researcher's Digital Literacy and Skills on Innovation Resilience in Government Science**

Existing literature in organizational behavior and innovation management highlights the integral role of digital literacy and skills in fostering innovation resilience (Nuryadi & Widiatmaka, 2023). Researchers' proficiency in navigating digital tools, analyzing big data, and leveraging emerging technologies contributes to an organization's ability to adapt swiftly to disruptions (Sudan et al., 2023), integrate innovative solutions (Popkova & Sergi, 2023), and sustain resilience in the face of technological challenges (Atinaf et al., 2023). In the context of government science, researchers' digital literacy and skills are anticipated to play a crucial role

in shaping innovation resilience. Proficient use of digital tools allows researchers to explore novel methodologies, collaborate seamlessly, and stay attuned to technological advancements (McCambridge et al., 2023). Therefore, the following hypothesis is posited:

**H3:** The researchers' digital literacy and skills level significantly influence innovation resilience in government science.

### **Mediatory Role of Researcher's Digital Literacy and Skills**

Existing research suggests that when communication policies provide guidelines for technology use and knowledge sharing, they foster a conducive environment for skill development (Fecher et al., 2023). In addition to fostering a conducive environment for skill development, well-crafted communication policies are pivotal in shaping a collaborative and innovative organizational culture (Aghaei & Mowlaei, 2023). By providing clear guidelines for technology use and knowledge sharing, these policies create a framework that promotes digital literacy and effective communication channels (Zhong et al., 2023). This synergy between communication policies and technological competence is particularly significant in today's dynamic work landscape, where rapid technological advancements necessitate continuous learning and adaptation. Moreover, organizations that prioritize comprehensive communication policies empower their employees to harness the full potential of emerging technologies (Kilag et al., 2023). This empowerment extends beyond technical proficiency to include effective collaboration and knowledge dissemination. As a result, employees become adept at leveraging digital tools not only for individual growth but also for the collective advancement of the organization (Rosário & Dias, 2023). Furthermore, the mediating role of digital literacy in translating communication policies into practical technological competence underscores the importance of investing in ongoing training and development programs (DePaula, 2023).

Exposure to sophisticated tools and technologies also stimulates skill acquisition, creating a more digitally capable workforce (Junod Perron et al., 2013). In the context of government science, we posit that the researchers' digital literacy and skills act as a crucial mediator, bridging the impact of government scientific communication policies and access to advanced research technologies on the overarching concept of innovation resilience. Effective communication policies and technology access are expected to contribute to developing digital literacy and skills among researchers (Thelen & Formanchuk, 2022). This access influences their ability to adapt to disruptions, collaborate effectively, and leverage emerging technologies, enhancing overall innovation resilience in government science (Abdul Rahman et al., 2020). Hence, the following hypotheses are posited:

**H4a:** Researcher's digital literacy and skills mediate the relationship between government scientific communication policies and innovation resilience in government science.

**H4b:** The researchers' digital literacy and skills mediate the relationship between access to advanced research technologies and innovation resilience in government science.

### **Moderating Role of Government Scientific Infrastructure**

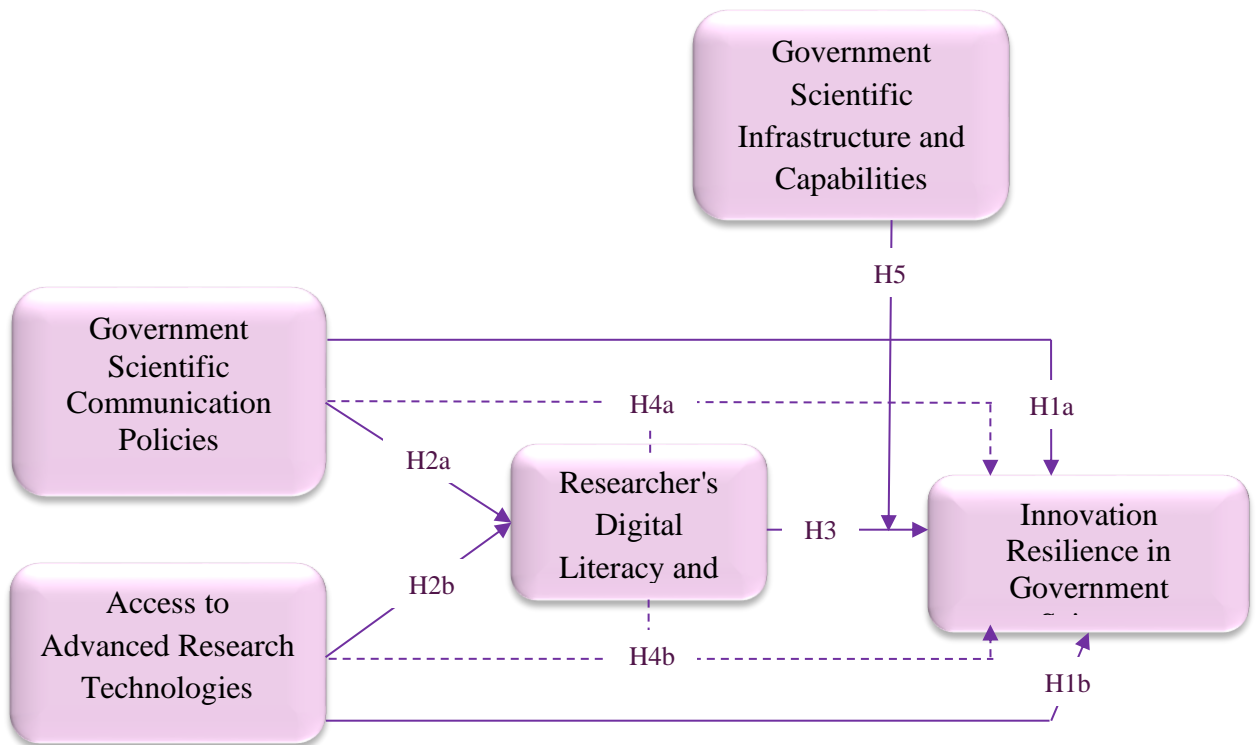
Scientific infrastructure encompasses laboratories, computing resources, and collaborative spaces, creating an environment that either amplifies or diminishes the effects of individual digital literacy and skills (Olaniyi et al., 2023). Government Scientific Infrastructure is proposed as a moderator in the relationship between researchers' digital literacy and skills and innovation resilience in government science (da Silva Neto & Chiarini, 2023). A robust

infrastructure is expected to enhance the positive effects of digital literacy and skills on innovation resilience (Agboola & Tunay, 2023). Researchers with advanced skills will be better positioned to leverage the available infrastructure, facilitating the implementation of innovative solutions, seamless collaboration, and effective adaptation to technological disruptions (Maulana et al., 2023). Conversely, a weak or inadequate infrastructure may impede the translation of digital literacy into practical innovation resilience. Hence, the moderating role of infrastructure is rooted in the understanding that a supportive environment can magnify the positive effects of individual capabilities, contributing to a more resilient and adaptive government science landscape. Therefore, the following hypothesis is posited:

**H5:** Government scientific infrastructure moderates the positive association between researchers' digital literacy and skills and innovation resilience in government science.

**Figure 1**

*Illustration of the Framework of the Study*



**Research Methodology**

This research aims to unravel the complex dynamics within government science amid rapid technological change. The data collection period spanned from January 2024 to June 2024, ensuring a current snapshot of the dynamic environment within government science. The target population for this study encompassed government scientists, researchers, and professionals engaged in scientific activities within government agencies and affiliated institutions in Indonesia. The target population included individuals involved in diverse scientific disciplines. Official databases of government science agencies, research institutions, and relevant professional networks were identified to construct the sampling frame, ensuring a comprehensive representation of the target population. A purposive sampling method was employed to select participants with expertise and experience relevant to government science.

The goal was to ensure a sample that captures a wide spectrum of perspectives within the government scientific community.

An online survey platform was employed allowing for efficient data collection and analysis. The survey link was shared through official communication channels of government science agencies, research institutions, and relevant professional networks in Indonesia. These channels included official email distributions, internal communication systems, and announcements on organizational websites and social media platforms. Survey language was English as the participants were more comfortable with that language due to the international nature of scientific discourse. Besides, the content used in the survey materials was carefully crafted to be clear, concise, and accessible to ensure participants from various scientific disciplines could easily comprehend and respond to the questions. This approach aimed to facilitate a more inclusive and representative sample, enhancing the reliability and validity of the collected data.

Given the complexity of the study and to achieve statistical power, the researchers collected responses from a minimum of 500 government scientists, ensuring a robust dataset for in-depth analysis. Ethical considerations were paramount throughout the research process. Participants were provided detailed information about the study's purpose, procedures, and rights. Informed consent was obtained from each participant before engaging in data collection activities. Measures were taken to maintain participant confidentiality, and data were anonymized during analysis to safeguard sensitive information.

### **Demographic Characteristics**

Demographic characteristics of the respondents were collected to gain a comprehensive understanding of the participants. The survey included a diverse group of government scientists, researchers, and professionals engaged in various scientific disciplines within government agencies and affiliated institutions. Participants represented a range of age groups. Most fell within the 25–34 years bracket (42%), reflecting a significant portion of early to mid-career professionals. The 35–44 age group constituted 30% of the respondents, indicating a substantial representation of mid-career individuals. Participants aged 45–54 comprised 18%, while those above 55 constituted 10%. The gender distribution was fairly balanced, with 58% identifying as male and 42% as female. This equitable representation reflects a gender-inclusive sample within the government science community. The study captured a diverse educational background among participants. Approximately 45% held a bachelor's degree, 32% had completed a master's degree, and 12% possessed a doctoral degree. This distribution reflects a mix of academic qualifications within the government science workforce. Respondents represented a variety of professional affiliations. About 28% were employed in government sectors, highlighting the significant presence of government scientists. Private industries represented 22% of the participants, demonstrating diverse employment sectors. 18% of respondents represented non-profit organizations, showcasing a varied professional landscape. The study included participants with varying levels of experience. Those with 5–10 years of experience represented the largest group (35%), indicating a substantial presence of mid-level professionals. Participants with 10–15 years of experience comprised 28%, while those with over 15 years of experience constituted 22% of the sample. This distribution reflects a balanced mix of early, mid, and experienced professionals in the government science community. The survey captured a broad spectrum of scientific disciplines. Life sciences accounted for 30%, physical sciences for 25%, social sciences for 18%, engineering for 15%, and interdisciplinary fields for 12% of the respondents. This distribution underscores the multi-disciplinary nature of the government science community.

## Study Measures

This study had two sections. The first section included demographic questions. The second section contained statements to measure the constructs. This study employed rigorously designed measures to comprehensively capture the multifaceted dynamics of government science, technology integration, and collaboration.

The first construct, government scientific communication policies, was assessed using 13 items adapted from DePaula (2023) and Longnecker (2023). Access to advanced research technologies was evaluated with 10 items modified from Zia et al. (2020). The construct, researchers' digital literacy and skills, drawn from Bejaković and Mrnjavac (2020) and Radovanović et al. (2020), had 5 items. Participants self-assessed their proficiency in using digital tools for scientific research and expressed their proactive engagement in enhancing digital skills relevant to their research field. Innovation resilience in government science was measured using 8 items adapted from Liang and Li (2023). Participants responded to items reflecting the adaptability of research initiatives to disruptive technological changes and the consistent innovation within the government science sector in response to emerging challenges. Finally, the government's scientific infrastructure and capabilities were assessed using 10 items adapted from Justman and Teubal (1995) and Yang et al. (2022). Participants provided insights into the adequacy of government-provided resources for scientific research infrastructure and the capabilities of such infrastructure in supporting cutting-edge research endeavors. In total, there are 46 items in the constructs. All statements were measured using a 5-point Likert-type with responses ranging from 1 = Strongly Disagree to 5 = Strongly Agree.

The survey data underwent a series of statistical analyses encompassing descriptive statistics, correlation analysis, and regression models. These analytical techniques were employed to unveil associations among variables. Table 1 below serves as a comprehensive reference, presenting crucial statistical values for the core constructs investigated in this study. Mean values, in particular, give insights into participant responses' central tendency, with higher means signifying a more favorable perception or a more pronounced presence of the respective construct. This approach facilitates a nuanced understanding of the interplay between Inclusive Decision-Making and Citizen Satisfaction.

Regarding Government Scientific Communication Policies, the mean score of 3.67 suggests a moderate level of perceived effectiveness, with a notable standard deviation of 1.15 indicating diverse participant perceptions. The construct exhibits moderate convergent validity (AVE = 0.60) and high internal consistency (CR = 0.88, CA = 0.81).

Access to Advanced Research Technologies, with a mean score of 4.12, indicates a relatively high perception, accompanied by a lower standard deviation of 0.89, reflecting more consistent views. The construct demonstrates moderate convergent validity (AVE = 0.63) and strong internal consistency (CR = 0.90, CA = 0.83).

Researchers' Digital Literacy and Skills, with a mean of 3.99, reveal a moderately positive perception, showing moderate variability (STD = 0.80). The construct demonstrates moderate convergent validity (AVE = 0.57) and robust internal consistency (CR = 0.83, CA = 0.73).

Innovation Resilience in Government Science, with a mean of 4.23, suggests a relatively high level of perceived resilience, with a lower standard deviation of 0.79. The construct exhibits moderate convergent validity (AVE = 0.59) and strong internal consistency (CR = 0.87, CA = 0.79).

Government Scientific Infrastructure and Capabilities, with a mean score of 4.07, indicates a relatively high perception, accompanied by considerable variability (STD = 1.01). The construct demonstrates moderate convergent validity (AVE = 0.52) and strong internal



consistency (CR = 0.81, CA = 0.75). These findings collectively contribute to a nuanced understanding of the reliability, validity, and participant perceptions across the study constructs.

**Table 1**  
*Mean, STD, Reliability, and Validity of the Study Constructs*

Construct	Mean	STD	AVE	CR	CA
Government Scientific Communication Policies	3.67	1.15	0.60	0.88	0.81
Access to Advanced Research Technologies	4.12	0.89	0.63	0.90	0.83
Researcher's Digital Literacy and Skills	3.99	0.80	0.57	0.83	0.73
Innovation Resilience in Government Science	4.23	0.79	0.59	0.87	0.79
Government Scientific Infrastructure and Capabilities	4.07	1.01	0.52	0.81	0.75

### Correlation Analysis

Table 2 below presents the correlation matrix, offering valuable insights into the relationships between the study constructs. A notable positive correlation is observed between government scientific communication policies and access to advanced research technologies ( $r = 0.511$ ), indicating that participants who perceive effective communication policies are also more likely to report enhanced access to advanced research technologies. Similarly, a positive correlation is found between government scientific communication policies and researcher's digital literacy and skills ( $r = 0.498$ ), highlighting a connection between clear communication policies and the perceived digital literacy of researchers. The correlation between government scientific communication policies and innovation resilience in government science is positive and moderate ( $r = 0.507$ ), suggesting that effective communication policies are associated with higher levels of innovation resilience. Access to advanced research technologies demonstrates positive correlations with a researcher's digital literacy and skills ( $r = 0.602$ ) and innovation resilience in government science ( $r = 0.399$ ), emphasizing the interconnectedness of technology access, digital skills, and innovation resilience. Moreover, government scientific infrastructure and capabilities exhibit positive correlations with all other constructs, ranging from 0.398 to 0.567, underlining the role of robust infrastructure in influencing communication policies, technology access, digital literacy, and innovation resilience. Overall, the correlation matrix provides a comprehensive view of the interrelationships among the study variables, contributing to understanding the dynamics within the context of government science.

**Table 2**  
*Correlation Analysis*

Constructs	1	2	3	4	5
Government Scientific Communication Policies	1.000				
Access to Advanced Research Technologies	0.511	1.000			
Researcher's Digital Literacy and Skills	0.498	0.602	1.000		
Innovation Resilience in Government Science	0.507	0.399	0.543	1.000	
Government Scientific Infrastructure and Capabilities	0.413	0.486	0.398	0.567	1.000

### VIF and Tolerance

The analysis included an assessment of potential multicollinearity among the variables by computing the Variance Inflation Factor (VIF) and tolerance values. The results revealed no concerns about multicollinearity, as evidenced by VIF values well below the widely

acknowledged threshold of 3 and tolerance values comfortably above 0.1 for all variables (Das et al., 2021; Noor et al., 2022). These findings offer assurance that the independent variables did not demonstrate high correlation, underscoring the robustness of the regression analyses conducted in this study. The absence of multicollinearity enhances the reliability of parameter estimates and contributes to the overall interpretability of the study's findings. This ensures that the results of the regression analyses accurately reflect the relationships between variables, strengthening the validity of the study's conclusions.

### Model Fit Indices

To assess the overall adequacy of the structural equation model (SEM) employed in this study, we examined various model fit indices, adhering to the guidelines established by Shmueli et al. (2019). These indices are pivotal in gauging how well the model aligns with the observed data. The chi-square statistic ( $\chi^2$ ) yielded a value of 419.89. While a lower  $\chi^2$  value typically suggests a better fit, it is imperative to consider that sample size can influence this statistic. Given the model's complexity with 156 degrees of freedom (df), the calculated chi-square/df ratio stood at 3.36, indicating a reasonably strong fit. Additionally, scrutiny of the Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI or NNFI) resulted in values of 0.90 and 0.92, respectively. CFI and TLI/NNFI values approaching 1, especially exceeding 0.89, signify a robust fit compared to a null model. The Root Mean Square Error of Approximation (RMSEA) was 0.06, slightly below the widely accepted threshold of 0.08, indicating a favorable fit. The Standardized Root Mean Square Residual (SRMR) returned a value of 0.05, reinforcing the assertion of a good fit. Furthermore, the Goodness of Fit Index (GFI) registered at 0.92, and the Adjusted Goodness of Fit Index (AGFI) recorded at 0.90, both surpassed the recommended threshold of 0.88, indicating a satisfactory fit. The normed chi-square statistic ( $\chi^2/df$ ) resulted in a value of 1.52, closely approaching 1, aligning with the characteristics of a well-fitting model.

### Hypothesis Testing

The regression results in Table 3 below provide nuanced insights into the relationships between key variables in the study, featuring beta coefficients, t-values, p-values, and overall support for each hypothesis. Hypothesis h1a, proposing a positive association between government scientific communication policies and innovation resilience in government science, is supported by a significant beta coefficient of 0.291 ( $t = 4.670$ ,  $p < 0.001$ ). This result suggests a robust positive relationship between effective communication policies and the ability of government science to innovate resiliently. Similarly, h1b, positing a positive link between access to advanced research technologies and innovation resilience in government science, is substantiated by a substantial beta coefficient of 0.345 ( $t = 6.279$ ,  $p < 0.001$ ), underscoring the crucial role of advanced research technologies in fostering innovation resilience within government science.

Regarding h2, h2a suggests a positive impact of government scientific communication policies on researchers' digital literacy and skills. The results reveal a significant beta coefficient of 0.201 ( $t = 4.030$ ,  $p = 0.001$ ), highlighting the importance of communication policies in shaping researchers' digital literacy and skills. Likewise, h2b, proposing a positive relationship between access to advanced research technologies and a researcher's digital literacy and skills, is validated with a notably higher beta coefficient of 0.473 ( $t = 7.480$ ,  $p < 0.001$ ). This validation emphasizes the influential role of advanced research technologies in shaping the digital capabilities of researchers.

Hypothesis h3, indicating a positive influence of researchers' digital literacy and skills on innovation resilience in government science, is strongly supported with a significant beta coefficient of 0.191 ( $t = 3.315, p = 0.005$ ), emphasizing the pivotal role of digital literacy and skills in enhancing innovation resilience.

The combined effect of government scientific communication policies and access to advanced research technologies on researchers' digital literacy and skills and, subsequently, on innovation resilience in government science is examined in h4a and h4b, respectively. Both hypotheses receive support with beta coefficients of 0.259 ( $t = 4.552, p < 0.001$ ) and 0.128 ( $t = 2.236, p = 0.009$ ), affirming the proposed relationships.

Last h5, exploring the interaction effect of government scientific infrastructure and capabilities with researchers' digital literacy and skills on innovation resilience in government science, garners support with a beta coefficient of 0.213 ( $t = 4.073, p < 0.001$ ). This support highlights the moderating role of government scientific infrastructure in shaping the relationship between digital literacy skills and innovation resilience.

As reflected in the revised regression results in Table 3, the moderation analysis sheds light on the interplay between government scientific infrastructure and capabilities as a moderator and the associations between a researcher's digital literacy and skills and innovation resilience in government science. Hypothesis h5 posited that government scientific infrastructure and capabilities would moderate the relationship between researchers' digital literacy and skills and innovation resilience in government science. The results reveal a significant beta coefficient of 0.213 ( $t = 4.073, p < 0.001$ ), reaffirming the presence of moderation. This moderation effect implies that the impact of researchers' digital literacy and skills on innovation resilience in government science varies depending upon the level of government scientific infrastructure and capabilities. In practical terms, when there is a higher level of scientific infrastructure and capabilities, the positive influence of researcher digital literacy and skills on innovation resilience is more pronounced.

**Table 3**  
*Regression Results*

	Hypothesis	Beta ( $\beta$ )	<i>t</i> -value	<i>p</i> -value	Support
H1a	Government Scientific Communication Policies → Innovation Resilience in Government Science	0.291	4.670	<0.001	Yes
H1b	Access to Advanced Research Technologies → Innovation Resilience in Government Science	0.345	6.279	<0.001	Yes
H2a	Government Scientific Communication Policies → Researcher's Digital Literacy and Skills	0.201	4.030	0.001	Yes
H2b	Access to Advanced Research Technologies → Researcher's Digital Literacy and Skills	0.473	7.480	<0.001	Yes
H3	Researcher's Digital Literacy and Skills → Innovation Resilience in Government Science	0.191	3.315	0.005	Yes
H4a	Government Scientific Communication Policies → Researcher's Digital Literacy and Skills → Innovation Resilience in Government Science	0.259	4.552	<0.001	Yes
H4b	Access to Advanced Research Technologies → Researcher's Digital Literacy and Skills → Innovation Resilience in Government Science	0.128	2.236	0.009	Yes
H5	Government Scientific Infrastructure and Capabilities* Researcher's Digital Literacy and Skills → Innovation Resilience in Government Science	0.213	4.073	<0.001	Yes

## Discussion and Results

The results showed a positive association between government scientific communication policies and innovation resilience in government science, underscoring effective communication's foundational role. Prior research aligns with our findings, emphasizing that transparent and frequent communication policies empower the government science sector to respond proactively to technological disruptions (Lee et al., 2023). This empowerment suggests that policies emphasizing clarity and transparency regarding scientific research updates enable a more agile and resilient government science sector (Fecher et al., 2023). Consistent with Bühler et al. (2023), the current study emphasizes the crucial role of access to advanced research technologies in shaping innovation resilience. The positive findings highlight that government initiatives providing state-of-the-art tools and equipment contribute significantly to researchers' ability to navigate technological disruptions (Mızrak, 2024). This finding underscores the importance of continued investments in cutting-edge technologies to bolster the sector's innovation resilience in the face of rapid technological change.

Our findings also reveal that effective government scientific communication policies positively influence researchers' digital literacy and skills, aligning with Reddy et al. (2023) emphasis on the role of communication policies in shaping digital capabilities. This result highlights that transparent policies foster resilience and play a pivotal role in equipping researchers with the digital skills necessary for effective navigation in a technologically dynamic environment (Tinmaz et al., 2023). The nexus between policy effectiveness and researchers' digital literacy is particularly noteworthy. As governments increasingly recognize the importance of science communication in the digital age, crafting and implementing policies that facilitate communication within the research community becomes imperative. When these policies are well-crafted and effectively implemented, they not only contribute to enhancing researchers' digital literacy but also serve as catalysts for the development of advanced skills in navigating the digital landscape.

This study's conceptual framework introduces the central construct of innovation resilience in government science, and our results validate its existence. The findings emphasize that the government science sector is adaptable to disruptive technological changes and consistently innovates in response to emerging challenges, underscoring the inherent ability of the sector to navigate disruptions and sustain a culture of innovation, aligning with the conceptual framework's vision. Recognizing the factors that bolster innovation resilience can guide policymakers in refining and tailoring strategies to fortify the sector's capacity to navigate disruptions effectively. Our study contributes to the theoretical underpinnings of innovation resilience and provides practical insights that can inform evidence-based policy decisions, fostering a resilient and innovative government science sector in the face of evolving technological landscapes and emerging challenges.

Finally, examining the interaction between government scientific infrastructure and capabilities with a researcher's digital literacy and skills, our results highlight a significant enhancement of the positive impact on innovation resilience. This result implies that a robust scientific infrastructure synergizes with digital literacy and skills, amplifying the sector's resilient innovation ability (da Silva Neto & Chiarini, 2023). It further depicts that adequate resources and capabilities provided by the government contribute substantially to building a dynamic and adaptable government science sector. Importantly, our results highlight that the government's provision of adequate resources and capabilities contributes substantially to building a dynamic and adaptable government science sector. This finding carries significant implications for policymakers, suggesting that investments in cutting-edge infrastructure and the continual development of researchers' digital literacy and skills can lead to a more resilient

and innovative scientific landscape. As we navigate the evolving challenges of the digital era, fostering a symbiotic relationship between infrastructure development and the digital capabilities of researchers emerges as a strategic imperative for sustaining innovation within the government science sector.

### **Theoretical Implications**

The study contributes to the integration of communication theories. It underscores the synergistic relationship between effective communication policies and technological readiness in fostering innovation resilience within government science. The positive impact of government communication policies on researchers' digital literacy and skills extends existing digital literacy theories. Thus, organizational communication strategies play a crucial role in shaping the digital capabilities of individuals within a professional context, highlighting the need for a more nuanced understanding of the interplay between communication policies and digital literacy. The study validates the conceptual framework by providing empirical evidence for innovation resilience as a central construct within the government science sector, contributing to developing theoretical frameworks focused on organizational resilience and innovation in the face of technological disruptions. The findings related to access to advanced research technologies align with technology adoption theories. The study enriches these theories by emphasizing the role of organizational initiatives, particularly government investments, in facilitating the adoption of cutting-edge technologies. The results of this study challenge traditional views by recognizing the external influence of policy and infrastructure on technology adoption.

The interaction effect of government scientific infrastructure and capabilities on innovation resilience contributes to integrating infrastructure theories with innovation theories. It sheds light on how a supportive infrastructure enhances the innovative capacity of an organization, emphasizing the importance of considering physical and organizational resources in fostering innovation. The study encourages future research to adopt a more context-specific lens in theory development. Moreover, by encompassing multiple variables and demographic factors, this study encourages an interdisciplinary perspective in organizational and government science research. It suggests that understanding innovation resilience requires insights from communication, technology, and infrastructure theories, emphasizing collaboration among disciplines to address the challenges posed by rapid technological change comprehensively.

### **Practical Implications**

Policymakers can use the study's findings to inform the formulation of government science policies. Emphasizing transparent and clear communication policies and strategic investments in cutting-edge technologies can enhance the sector's resilience to rapid technological changes. Policymakers should consider communication strategies that promote frequent updates on scientific research and funding changes. Government entities responsible for science funding and infrastructure development can strategically invest in advanced research technologies. Providing state-of-the-art tools and equipment to researchers enhances their ability to navigate technological disruptions and ensures the government science sector remains at the forefront of innovation. Research institutions and government agencies can implement training programs to enhance researchers' digital literacy and skills. Such activities include opportunities for researchers to actively seek and participate in programs that improve their digital proficiency. Such initiatives will contribute to building a workforce adept at leveraging digital tools for scientific research.

Government bodies responsible for scientific infrastructure can also focus on building and enhancing infrastructure capabilities. Adequate resources and capabilities are essential for supporting cutting-edge research endeavors. Investing in the physical and organizational aspects of scientific infrastructure contributes significantly to the innovation resilience of the government science sector. Organizations within the government science sector can tailor interventions based on demographic insights obtained from the study. Understanding how age, gender, education, professional affiliation, geographical location, years of experience, and scientific discipline influence perceptions can guide the development of targeted programs and policies that meet the diverse needs of individuals within the sector.

Furthermore, the study encourages organizations to promote interdisciplinary collaboration within the government science sector. Organizations can foster a collaborative environment that brings together experts from diverse disciplines by recognizing the interplay of communication, technology, and infrastructure. This collaborative approach enhances the sector's ability to address challenges and seize opportunities presented by rapid technological change. Organizations should adopt a continuous monitoring and adaptation culture to stay abreast of technological changes. Regular assessments of communication policies, technological readiness, and infrastructure capabilities are essential because they enable organizations to proactively adapt to emerging challenges and opportunities, ensuring sustained innovation resilience. Capacity-building initiatives can be implemented to strengthen the skills and capabilities of individuals within the government science sector. These initiatives may include workshops, training programs, and mentorship opportunities focusing on digital literacy and utilizing advanced research technologies. Moreover, government science entities can engage in international collaboration and benchmarking to learn from best practices worldwide. Comparing strategies and approaches with other nations can provide valuable insights and inspire innovative solutions to challenges posed by rapid technological change.

### **Limitations and Future Research Directions**

The study's cross-sectional design limits the ability to establish causal relationships between variables. Future research could employ longitudinal designs to capture temporal changes and provide a more robust understanding of the causal pathways between government science policies, technological factors, and innovation resilience. The reliance on self-report measures introduces the possibility of social desirability bias, where participants may provide responses that align with perceived expectations. Future research should incorporate objective measures or a mixed-methods approach to validate findings and mitigate potential biases associated with self-reported data. The study focused on a specific government science sector, potentially limiting the generalizability of findings to diverse government science contexts. Future research could explore variations across different sectors, such as health, environment, and defense, to uncover sector-specific nuances in the interplay of communication, technology, and innovation resilience. The study did not include an international comparison, limiting insights into how government science sectors in different countries navigate technology disruptions. Future research could expand its scope to include an international perspective, facilitating a comparative analysis and uncovering global patterns in government science resilience.

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