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Democratizing Science Communication for All: Public Relations as a Tool for Inclusive Education in NCSM's Outreach Programs for the Marginalized Communities

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Abstract

This paper investigates the role of Public Relations as a tool for democratizing science communication among marginalized communities in West Bengal, through a case study of the outreach educational programs conducted by the National Council of Science Museums (NCSM), which is an autonomous institution under the Ministry of Culture, Government of India. Focusing on NCSM's national units in West Bengal, specifically Science City, Kolkata, and the Birla Industrial and Technological Museums, Kolkata, as well as the district science centers in Bardhaman, Digha, Siliguri, and Purulia, the study adopts a qualitative approach, utilizing personal interviews and content analysis of annual reports and communication materials.

Structured around the dimensions of accessibility, inclusion and participation, the paper critically assesses outreach initiatives and cultural advocacy of the council, like the rural science demonstrations, bilingual puppet and street theatre performances, Mobile Science Exhibitions (MSEs) and Innovation Hubs. These programs are designed to reach school children aged 5–16 in semi-urban and rural areas, making science both approachable and culturally resonant. Particular attention is given to how NCSM facilitates engagement through local languages, traditional art forms and community-centered formats.

The paper also explores flagship events like the National Science Seminar and National Science Drama Competitions as platforms that empower youth from underrepresented regions to participate in scientific discourse and expression. Through its public relations-driven model for science education, NCSM enables a bottom-up science culture where communication is shaped by community needs rather than imposed from institutional centers.

By framing science communication as a socially embedded and culturally adaptive practice, this study positions NCSM's outreach as a scalable model for inclusive science engagement in India. The findings contribute to the evolving discourse on media, marginality, and public communication, demonstrating how localized strategies can bridge systemic inequities in access to knowledge.

Keywords: #ScienceCommunication #PublicRelations #MarginalizedCommunities #InclusiveEducation #WestBengal #DigitalAccess

1. Introduction

Science communication is defined as the use of systematic knowledge in forms that educate, engage and touch various audiences. For a nation as culturally and linguistically heterogeneous as India, where access to quality education as well as scientific knowledge is unevenly distributed, democratization of science communication is not only an educational imperative but a social requirement. Science outreach in India tends to miss the marginalized communities, belonging to rural and semi-urban sectors, because of the historic top-down model, hierarchical institutional and societal divisions (Kumar, Priya, Patel, & Gupta, 2024). This obsolete model is further exploited by systemic obstacles such as language, cultural gaps and underrepresentation.

1.1. Public Relations as a Tool of Science Communication

Public Relations (PR) functions as a powerful tool within the framework of science communication, It promotes scalable social inclusivity, as it is in this context that brings out educational transformation, in different strata of society. PR is a comprehensive management functionary, not only it helps in building trust and shaping narratives but on outcome, facilitates dialogues among communities and organizations (IPRA, 2019). It offers a framework through which outreach for science education and awareness can be aligned with the cultural and social realities of the marginalized groups, their thought culture, perspectives, and mindset. It cultivates meaningful relationships between institutions and communities but also helps them to move beyond top-down messaging and embrace participatory, culturally sensitive two-way communication models. Public Relation in India has always held a significant role, first in disseminating information about government policies, schemes and programs, and secondly, shaping public opinion and ensuring citizen engagement. According to Singh (2019), strengthening PR is necessary for any government organizations to ensure welfare of its citizens and empowerment of communities and groups. Despite this potential, there remains a huge gap between theory and practical applications of PR (Zimmerman, Tsbari, & Tal, 2024). To address this issue, application of Science Communication strategies, varied in approaches and mediums, is required that fosters collaboration between organizations and stakeholders (Metcalf, Gascoigne, Medvecky, & Nepote, 2022). Science communication is to be reimagined, which is required, as a socially embedded and culturally adaptive practice, focusing on delivering information, plain and simple in accessible, engaging and relevant formats.

1.2. NCSM and the Science Centre Movement in India

The National Council of Science Museums (NCSM), an autonomous scientific society turned organization under the Ministry of Culture, Government of India, has been one of the most significant propagators and popularizers of science education in India for more than four decades now, among others. Established in April 4, 1978, with the vision to promote scientific temperament and popularize science education in India, its origin is rooted in the Science Centre Movement of the 1960s (NCSM, n.d.). As it was a major step towards making science education more interactive, practical, experiential and accessible foremost, this movement gained momentum with the establishment of the Birla Industrial and Technological Museum (BITM), Kolkata, on May 2, 1959 (Sthanapati, 2024). It laid the foundation for a network of science centers and museums across the country with the vision to unify them all under the umbrella of National Council of Science Museums, later on. Over 40 years of its service and operation, NCSM has considerably expanded its branches through a tier system structure of national, regional and district-level centers, each established to cater to the specific needs of its local inhabitants. Through state-of-the-art interactive

exhibits, indigenously designed mobile science exhibitions covering nooks and corners of the nation, innovation hubs and science festivals welcoming thousands of participants each year, it has created a niche platform where science is not confined to textbooks only but becomes practically a lived experience. NCSM's commitment to inclusivity is reflected in its outreach and awareness programs that target marginalized regions of the country in different states, using local languages, depending upon its folk traditions, and culturally resonant formats to communicate scientific ideas.

1.3. Rationale of the Study

This paper attempts to explore the role of Public Relations as a transformative tool in Science Communication, focusing on the outreach programs of the National Council of Science Museums (NCSM) in and across West Bengal. It considers measurably the activities of the units of NCSM situated in West Bengal – (1) BITM, Kolkata (2) Science City, Kolkata and district centers in (2) Bardhaman, (3) Digha, (4) Siliguri, and (5) Purulia. The paper critically examines how NCSM leverages local languages, traditional folk art forms, and community-centered approaches and formats to foster scientific temper among marginalized populations, through qualitative analysis of interviews, annual reports and communication materials, as prime. By that means and methods, it contributes to the broader discourse on media, marginality and public communication, bringing out the insights and shedding light on still obscure areas of science communication, into how localized strategies can bridge structural inequities, within our Indian society, in pursuit of scientific knowledge.

2. Literature Review

Science Communication is intertwined with Public Relations in India, with PR being the key tool for achieving the goals of the former. With the increasing urge for disseminating information and developing scientific solutions to social problems, the democratization of science communication has become particularly important in recent years (Iqbal, Mitra, & Joy, 2023). Besides, there is also a huge requirement for bridging the systemic imbalances in access to scientific information and promoting scientific temperament among individuals, especially those belonging to marginalized communities. In this scenario, institutions like the National Council of Science Museums (NCSM) have assumed pivotal roles in educating people and fostering inclusive engagement through varied outreach activities across the nation. By framing scientific knowledge in accessible formats and culturally resonant narratives, public relations thus become central to democratizing science communication and ensuring that the scientific discourse is inclusive, participatory and socially embedded.

2.1. Policy Frameworks and Science Communication

The Government of India has been functioning actively to develop marginalized communities through targeted science outreach and education programs. In this context, the Public Relations officials of government agencies play a significant role as facilitators of science communication. They act as 'network managers', encouraging collaboration and sharing of scientific information between the organization and its public (Sugiono & Salamah, 2021). The National Council for Science and Technology Communication (NCSTC) communicates scientific information for supporting societal development in the country. It employs a two-way participatory approach through local collaboration and culturally adaptive media like folk art, mobile science labs and hands-on workshops for enhancing visibility, accessibility and public participation (DST, 2024). Besides, the Science Media Communication Cell (SMCC) of the CSIR-NIScPR

propagates information on R&D breakthroughs and research benefits of Indian scientific institutions among the disadvantaged communities through different public engagement platforms like print, digital, audio-visual, etc. (CSIR-NIScPR, 2021). This highlights how different government agencies deploy different PR and communication strategies for democratizing science education and increasing its accessibility for the remotest areas of India.

Further, the development of the Indian S&T and Innovation Policy (ISTIP) helped in asserting the critical gaps in the understanding of the country's innovation landscape and led to the development of innovation-led interventions for addressing national challenges (ISTIP, n.d.). Another milestone that was achieved, was the construction of the Scientific Social Responsibility (SSR) – a framework published by the DST, setting out clear guidelines for the harness of latent potential in the nation's scientific community. It aimed to significantly reduce the gaps between the spectrums of 'science-society', 'science-science' and 'society-science', and resulted in fostering a stronger and more responsive scientific network in the country (Department of Science and Technology, 2022). The SSR module and framework ensures that the advantages of scientific research are accessible to disadvantaged and marginalized groups, thereby creating a vibrant S&T ecosystem (Iqbal, Mitra, & Joy, 2023). Additionally, the Science, Technology and Innovation Policy (2020) propose the development of Science Media Centers at national and regional levels to connect science education, subject experts, and the media with the general public and enthusiasts. & emphasizing on the role of science communication, this policy highlights the relevance of mediums from traditional participatory models like folk theatre and folk storytelling, analog media such as community radio and digital media, comparatively, alike.

2.2. Role of Media and Public Relations in Reaching the Marginalized Voices

The premeditated association of Public Relations with community-based outreach activities is increasingly recognized as crucial for gaining visibility and stakeholder trust. Thomas and Omojunikanbi (2024), posited that effective PR leads to the development of trust and shared values between organization and community. Another study showed that PR helps to overcome the digital divide, helping in accomplishing an inclusive digital environment, through targeted communication and training (Hidayat, et al., 2024). PR is, therefore, a vital element stimulating community education by amplifying outreach efforts through inclusive and participatory initiatives. It caters to the needs of both privileged and underprivileged groups by making use of various forms of media, customized according to their needs, ranging from traditional to modern. The Sprint Survey of 2024-25 conducted by PRCAl, identified the advancing importance of hyperlocal format of storytelling and several culturally sensitive media forms as key communication tools, especially for the areas which are underprivileged in socio-economic nature (PRCAI, 2024). Another effective medium providing voices to the marginalized is the Community Media, catering to societal issues like caste oppression, child marriage, etc. (Singh R. P., 2022). As such, the media profoundly shapes the attitudes, behaviors and norms followed by people (N. & P., 2019). It acts as an unavoidable factor in determining PR strategies for educating the disadvantaged sections of the society. Indian media is acclaimed to have a multifaceted role and approach in community outreach and awareness, decentralizing and democratizing education, interlacing knowledge gaps and facilitating inclusive education and learning (Kumar P., 2024). For instance, these days social media has become very vital for minority communities in India as it gives them a platform to voice their opinions and concerns. Mainstreamed Movements like #DalitLivesMatter and #MeTooIndia were significant as they proved the importance of this new media in catering to the needs of the marginalized (Dey, 2025).

Yet, there remains a huge gap due to the predominance of organizational goals in relation to community needs. Studies highlight the lack of media legitimacy while shaping public opinion and strengthening communication (Vorontsov, Goloborodko, Ponedelkov, & Shteinbukh, 2019). Some areas still find limited participation of marginalized groups in decision-making, leading to creation of echo chambers, barring the process of decision-making (Grunig, 2006). This can only be solved with the employment of community-based participatory research, a collaborative effort promising mutual benefits for both (Aghazadeh & Aldoory, 2023). Therefore, media acts as a catalyst empowering marginalized voices in India and all over the world when utilized using participatory and culturally sensitive approaches.

2.3. Science Communication in Marginalized Communities

In the present scenario, Science Communication has advanced from traditional models to include frameworks that focus on equity, cultural relevance and local needs. It has given rise to the concept of Inclusive Science Communication (ISC), a transdisciplinary movement grounded in reciprocity and intersectionality. It not only advocates for the inclusion of minority groups in dominant frameworks, but also demands for reframing of the existing contexts to reflect diverse histories, assets and epistemologies like 'participatory museum practices' and 'community-rooted citizen science' (Dawson, 2018). ISC posits that science communication should include equity framing in order to become a more socially responsive practice catering to the needs of every section of the society (Polk & Diver, 2020). However, there are a number of barriers obstructing the smooth application of the ISC initiatives. This calls for stronger organizational support and intensified connectivity between community and communicators. In the Indian context, science communication faces complex challenges which require dynamic solutions centering on social, cultural and economic prospects. It needs promoting science through various activities crafted with considerations for the cultural and religious contexts of the country (Raghu, Amruth, & V., 2023). Besides, there is also a need for developing communication skills in the recipients for ensuring a smooth transfer of knowledge. Studies have found that students develop these skills through the use of structured communication and mentorship and interactive platforms (Faber, Colthorpe, Ainscough, & Kibedi, 2024). Therefore, ISC in India demands a deliberate shift from 'one-size-fits-all' outreach to culturally adaptive, community-rooted engagement enabling accessibility, inclusivity and participation of every individual of the society.

2.4. Gap in Literature

While PR and Science Communication have received increased attention in policy making and academic discourse in India, there remains a remarkable gap in the comprehension process of how these find application in actual scenarios, particularly within marginalized communities. There is limited empirical evidence on how organizations operationalize participatory outreach activities in reality. Moreover, though the concept of Inclusive Science Communication has attained global popularity, its application in the Indian context, especially West Bengal has not been studied sufficiently. Besides, there is also a gap in exploring how marginalized groups contribute to shaping science outreach activities, facilitating a two-way communication process. These gaps showcase the need for clear, regionally grounded analysis for bridging policy intent with grassroot realities.

3. Theoretical Framework

This study draws on a diverse set of multidisciplinary PR, communication and organizational theories to examine how the science outreach initiatives can be made more inclusive, accessible and participatory. They help in understanding the different aspects of communication between an organization and its stakeholders, particularly the communities. Ultimately, they provide a foundation for apprehending the ways in which science communication can be reframed to serve marginalized people in better ways, enabling meaning dialogue between the two.

3.1. Two-Way Symmetrical Model

The Two-Way Symmetrical Model of Public Relations, given by Grunig and Hunt, focuses on mutual dialogue and understanding between an organization and its public. It alters the position of communicators from authoritative to receptive, highlighting the importance of audience-centered strategies for developing communities. This model allows communities to express their concerns, share local knowledge and shape the direction of an organization's outreach activities (Willacy, 2016). It also identifies a gap in existing strategies as communicators refuse to willingly engage in dialogue with the audience and also do not use ethical messaging practices hindering the process (Yuan, et al., 2017). Therefore, the Two-way Symmetric Model offers a transformative framework for science communication, focusing on the mechanism of dialogue and reciprocity.

3.2. Excellence Theory

The Excellence Theory of Public Relations is one of the most popular frameworks used for augmenting institutional effectiveness. This theory focuses on the need for catering to societal necessities and stakeholder goals for organizational development through 'symmetrical communication', thereby building trust and relationship with the public (Grunig, 2008). According to Nixon (2013), this theory acts as an 'ethical commitment' to homogenize access, co-produce knowledge and lead culturally-resonant outreach programs. It stresses on the need for clarity, responsiveness and developing kinship, encouraging communicators to engage in regular conversation with public. Therefore, the Excellence Theory shows the significance of two-way communication in adapting to community-based outreach initiatives, offering a standardized foundation for embedding science communication within institutional strategy, fostering accountability, inclusion and public trust.

3.3. Diffusion of Innovation Theory

The Diffusion of Innovation paradigm by Everett Rogers attempts to explain the rate at which an innovation is gradually adopted by the members of a society. It describes the process of how new information passes through different stages (awareness, interest, persuasion, decision, adoption and confirmation) for adoption by a community (García-Avilés, 2020). In the context of science communication, Rogers' theory provides a strategic lens for analyzing how scientific ideas move from science communicators to the audience, shaped by communication channels, opinion leaders and social norms (Dearing, 2009). It stresses the importance of targeted interventions for promoting science (new information) among the marginalized communities, due to their lack of knowledge and skepticism. Thus, this theory provides a foundation for examining the science outreach initiatives undertaken by any organization, illustrating the need for designing outreach that creates awareness, supports persuasion and facilitates adoption.

3.4. Participatory Communication Model

The Participatory Model of Communication is a widely acclaimed for reimagining communication as a dialogic, conversational process rather than a one-way, top-down approach. Originating from Paulo Freire's pedagogy of communication, this model positions audience as active agents rather than passive recipients of knowledge (Chen, Hsueh, Chiang, & Chiu, 2025). It facilitates an environment for integrating local voices, culture and indigenous knowledge into communication strategies, promoting inclusivity and legitimacy (Servaes, 2008). In science communication, this model is centered on embedding science in society and is linked with the ideals of democracy and equality (Rosewater, 2024). It facilitates horizontal flow of information and underlines the importance of trust, culture and stakeholders in the design and delivery of outreach initiatives. Thus, the Participatory Communication Model challenges traditional models by positioning marginalized communities as active respondents in shaping scientific discourse.

3.5. Media Ecology Theory

The Media Ecology Theory, given by scholars Marshall McLuhan and Neil Postman, forms a base for examining how media shape human perceptions and cultural experience. This theory considers media as creators of messages, deciding how they are produced, received and understood (Li, 2024). According to Strate (2008), various media create unique possibilities and constraints for engagement of people. Considering science communication, the Media Ecology theory is specifically pertinent for examining the interplay between traditional, performative, and digital media. It underlines the significance of identifying not only as channels of communication but as 'environments' that facilitate inclusivity, accessibility and reciprocity. By applying this narrative, science communication initiative can be assessed for their ability to diversify media ecosystems, remove barriers and culturally sound outreach that meet the needs of the communities.

4. Research Methodology

This paper adopted a qualitative approach to investigate how the Public Relations strategies employed by the National Council of Science Museums (NCSM) facilitate inclusive science communication for the marginalized groups in West Bengal. The study is based on participatory and interpretive paradigms, and uses a multi-site case study framework to capture the various institutional practices, media narratives and outreach models across NCSM's network, particularly in West Bengal. This approach allows for the triangulation of data sources by integrating communication materials like press releases and annual reports, interview of internal stakeholders of the organization and related media coverages.

4.1. Research Design

The research is structured as a multi-site case study focusing on NCSM's units in West Bengal, which encompasses two national-level centers – Science City, Kolkata and Birla Industrial and Technological Museum (BITM), Kolkata, and four district-level centers (also known as Satellite Units) in Bardhaman, Siliguri, Digha and Purulia. These units were purposively selected to showcase a combination of urban, semi-urban and rural contexts, each having a different portfolio and target audience. By investigating the PR and science outreach efforts in these varied locations, the design helps in conducting a comparative analysis of localized strategies, institutional significances and community adaptations. within NCSM's broader outreach ecosystem. This structure also aids in the identification of scalable practices and context-

specific adaptations within NCSM's broader outreach ecosystem, directly addressing the main aims of the study.

4.2. Data Collection

The data for this study was collected through both primary and secondary sources, employing a mixed-method approach.

1. Primary Data:

The primary data for this study was gathered from the organization's decision-makers, who design, implement and communicate outreach programs. The following tools were used for this process:

i. Unstructured Interviews: Face-to-face and online personal interviews were conducted with the key stakeholders of NCSM. Participants included:

- Public Relations Officer (PRO), NCSM
- Deputy Director General (DDG), NCSM
- Directors of Science City, Kolkata and BITM, Kolkata
- Education Officers of Science City, Kolkata and BITM, Kolkata
- Project Coordinators of the district-level centers in Bardhaman, Purulia, Digha and Siliguri

These interviews discovered themes such as participatory outreach design, media framing, regional adaptation and institutional challenges in engaging marginalized communities.

ii. Close-ended Questionnaires: Structured questionnaires were distributed digitally to institutional stakeholders, who were interviewed, to capture standardized data on:

- Role-specific outreach responsibilities
- Perceptions of inclusivity and community engagement
- Use of folk media and regional formats in science communication.

Administering the questionnaire to interviewees enabled cross-validation of qualitative insights with quantifiable patterns, enhancing the reliability of findings.

2. Secondary Data:

The secondary data for this study was extracted from existing organizational documents, media archives, and public records using the following methods:

i. Content Analysis

- a. Analysis of Annual Reports:** Conducted thorough review of last 10 years Annual Reports of NCSM (2014–15 to 2023–24), focusing on outreach programs for marginalized groups, MSEs, workshops, lectures, and folk media formats.
- b. Review of Press Releases and Media Coverages:** Analysis of official press releases and media coverages of NCSM and its centers in West Bengal for understanding how outreach activities are framed and communicated publicly. They were also analyzed for records of NCSM's flagship events like the National Science Seminar and National Science Drama competitions for evaluating youth participation and regional representation.

4.3. Sampling Strategy

This study assumed a determined sampling strategy to identify institutional stakeholders (mainly officials, heads of departments, collaborators, scientists) directly involved in the designing, implementation and communication of science through outreach programs within the organizational structure of NCSM. Sampling options were also supported by the review of NCSM's annual reports (F.Y 2014-15 to 2023-24) contributing in furnishing a detailed documentation of outreach formats, target communities and institutional roles.

The sampling choices and process were guided by the following considerations:

- **Institutional Relevance:** The units that have been selected for the study, represent a mix of these ternary outreach contexts in—urban, semi-urban, and rural sectors of West Bengal, each with distinct portfolios and community engagement strategies.
- **Role-Based Inclusion:** Stakeholders were picked and chosen based on their documented involvement in the definitive outreach and public relations activities, as reflected in the annual reports, press releases by NCSM and Ministry of Culture alike, and media coverages.
- **Data Triangulation:** To support triangulation across data sources across fields and ensuring that both strategic and operational perspectives were taken into account, sampling was designed likewise. Interviewees were also administered structured questionnaires (Facts and Figures both) to validate and quantify qualitative insights.
- **Contextual Diversity:** By selecting stakeholders from multiple sites with varied geographic and demographic profiles, and as well as accessibility concerned, the strategy enabled comparative analysis of local outreach models and participatory PR practices by the communicators for science education, especially in relation to marginalized communities.

4.4. Analytical Framework

The analytical framework is based on a qualitative approach, which is interpretive in nature as well, combined with thematic analysis with institutional and media discourse analysis to examine how Public Relations (PR) strategies within NCSM's service and operation facilitate inclusive science communication for marginalized communities in West Bengal.

This framework integrates three interrelated contexts:

1. **Thematic Analysis of Stakeholder Narratives:** Responses of all Interviews and questionnaires were thoroughly reviewed to find themes like participatory outreach, regional adaptation and inclusivity that are in common. These themes were then linked to the roles of different personnel to understand how they engage with marginalized communities.
2. **Institutional Discourse Analysis:** Annual reports of NCSM (F.Y. 2014-25) were meticulously examined, to see how the organization talks about inclusion and outreach in relation with science education for communities with less access. This helped track changes in outreach formats and identify key priorities over time.
3. **Media Framing and Representation Analysis:** Press releases and media coverage posts were analyzed to understand how NCSM's outreach programs and awareness success rate is presented before the public. The focus was on language, images, and storytelling, especially how marginalized groups and participatory formats are represented.

4.5. Ethical Considerations

All interviews and interactions were conducted with informed consent, ensuring confidentiality and voluntary participation. The study adheres to ethical standards for research involving human subjects, with sensitivity to institutional representation and community narratives.

5. Findings and Analysis

The findings of this research are based on a multi-layered analysis of how Public Relations strategies of NCSM promote inclusive science communication for the marginalized people of West Bengal. It emerges from the triangulation of organizational communication materials, media narratives and stakeholder interviews across the units of NCSM situated in West Bengal. Categorizing the findings into different thematic clusters, it attempts to identify the facilitators and barriers of PR as an instrument for democratizing science communication among disadvantaged groups.

5.1. PR as a Strategic Enabler of Inclusive Engagement

Public Relations was consistently recognized as a critical component of NCSM's outreach mission by the respondents in both interview and questionnaire. Interviewees described PR as a strategic tool bridging institutional goals and community realities, rather than perceiving it as a mere peripheral promotional tool. According to them, PR transforms technical and scientific content into culturally comprehensible formats for the marginalized communities. This was also reinforced in the communication materials of NCSM, which highlighted the regular use of certain community-based media like Mobile Science Exhibitions and folk media like Street Plays and Puppetry for the institution's outreach activities.

PR Strategies used by NCSM	Frequency
Collaboration with Governments and NGOs	High
Social Media Campaigns	High
Traditional Art Forms	Moderate
Community Engagement Programs	Moderate
Media Coverage	Moderate
Local Partnership	Moderate

Table 1: PR Strategies Used by NCSM in its Outreach

The respondents reported that NCSM and its units made frequent use of collaborative strategies with government bodies, NGOs and local institutions for reaching the grassroots of the society. Among the media used, MSE and Social Media Campaigns largely dominate NCSM's outreach, while science demonstrations and traditional media like puppetry and street plays are equally important. Besides, school visits and innovation hubs also occupy a significant share of the outreach strategies. On the other hand, mainstream media like TV and radio were found to be used less suggesting a transition from a centralized to decentralized and interactive approach. In spite of utilizing this varied strategies, the existing PR practices were found to be highly unidirectional. Though there was occasional involvement of local influencers like teachers and community leaders, feedback mechanism remained underdeveloped, thereby representing a gap between theory and practice. Also, respondents reported the issue of uneven adoption of new strategies by the units due to financial and manpower constraints.

5.1. Institutional Outreach Practices

The longitudinal analysis of the NCSM's annual reports over a decade (2014-15 to 2023-24), coupled with stakeholder interactions at both national and district levels (limited to West Bengal) showcase the significant growth in the organizations' outreach activities over the years. The Mobile Science Exhibitions can be acclaimed as the most scalable strategy in this genre. Launched first by BITM Kolkata, MSEs have expanded from 23 buses in 2014 to 48 in 2024 across the country, including 25 aspirational districts. In West Bengal, BITM, DSC Digha, BSC Bardhaman, DSC Purulia and NBSC Siliguri consistently use MSEs for reaching the remotest areas of the state and educating the marginalized communities, especially students. Yet, interviewees revealed that though the use of MSEs has increased over the years, participation and localized adaptation remain limited, thereby limiting dialogic communication.

Apart from this, NCSM has also expanded its strategies from once-in-a-while community visits to structured schemes like 'Taking Art to the Masses by 2023-24' facilitating regular visits to underprivileged areas for conducting different activities like science workshops and demonstrations. The annual reports also showed that national centers like BITM and Science City, Kolkata are continuously engaged in facilitating visits for children from the marginalized communities. The district centers also showed a notable increment, with Bardhaman's outreach rising from 1024 participants in 2022-23 to 5,726 in 2023-24, Purulia involving around 3000 children and Siliguri reaching 4758 children in 2023-24. However, the stakeholders confirmed that the program design is largely top-down and needs to be restructured to include two-way communication. Besides, units like Siliguri and Bardhaman have also advanced gender-inclusive communication from symbolic observances to pragmatic workshops on STEM, health, entrepreneurship, etc., leading capacity-building programs for girls and women, particularly from the underprivileged areas. In addition to this, centers like Siliguri and Purulia also conducted anti-superstition outreach campaigns using participatory media like folk theatre, street plays and puppetry for educating local audience on societal issues.

5.2. Fostering Cultural Inclusivity

Culture plays a crucial role in determining the PR strategies for NCSM, with traditional media and storytelling occupying the central role. The 2019 conference on Indian crafts, organized by Science City, Kolkata illustrated this approach by endorsing the importance of local information systems and placing crafts as sources of empirical knowledge and technological intricacy. The 'Vaccines: Injecting Hope' and 'Superbugs: The End of Antibiotics?' are flagship projects of NCSM aimed at simplifying complex scientific concepts into accessible narratives for common people. These projects made use of thematic storytelling for communicating with the audience, through the means of exhibition, demonstrations and MSEs, catering to the semi-urban and rural communities. The communication was mainly conducted in the local language of the area, however, according to the respondents, cultural contextualization is very uneven. While some programs blend with the cultural narratives of the people, others remain superficial, lacking local touch. This suggests that the use of local language for inclusion, though valuable, does not guarantee deeper ethnic adaptation.

Media formats like street plays, puppetry and school-based outreach were claimed as most effective in reaching marginalized communities, with MSEs occupying the major role due to its accessibility and mobility. The respondents also mentioned the under-utilization of potential media like WhatsApp and Community Radio, suggesting the need for moving beyond traditional approach to adopt a combination of different channels for fostering cultural inclusivity, along with approachability. In addition to this, the dedicated Innovation Hubs provide experiential science education in local to the students belonging to

every section of the society. NCSM also organizes various national-level competitions like the National Science Seminar and National Science Drama for promoting budding talents through financial and psychological aids. These competitions give platforms to the underprivileged children for showcasing their talent in front of the world, thereby fulfilling the main objective of the organization's outreach activities. Most of these events have a multi-linguistic nature. These findings describe the efforts of NCSM to foster cultural inclusion in its outreach programs.

5.3. Media Framing

The analysis of the press notes and media coverages of NCSM reveals that the organization uses narrative framing as a primary tool of institutional validity and projection of inclusivity. An overriding strategy here, includes the use of commemorative and historical framing, positioning events like the 'Golden Jubilee of the Mobile Science Exhibitions' (2015) not just as milestones, but as proof of heritage and institutional durability, fostering public trust by stimulating collective memory. Another persistent framing highlights cognitive inclusivity. This is achieved by portraying native traditional crafts and participatory festivals as legitimate forms of science, in comparison with the Western paradigms, thereby broadening the psychological base of science communication. NCSM also uses cultural and participatory framing in its media outreach for enhancing accessibility and emotional engagement by linking complex scientific topics with everyday experiences. Media coverage of the innovation festivals and competitions reinforce this narrative making science communication participatory and youth-driven.

5.4. Barriers and Challenges

There are several barriers that limit NCSM's PR-driven inclusive science communication. According to the respondents, structural constraints like distance, finance and lack of awareness restrict participation in rural and semi-urban areas. Besides, shortage of trained staff, uneven resource allocation and limited visibility in the national media act as institutional constraints in the organization's outreach. The absence of a systematic feedback mechanism also highlights the issue of a lack of human resources and proper planning. Addressing this issues requires not only structural reforms but also capacity-building initiatives and more media engagement to ensure equity, sustainability, and scale.

6. Limitations

The research offers valuable insights into the role of PR in promoting science communication among marginalized communities. However, there remain some limitations that need to be addressed. Firstly, the research is geographically constrained to West Bengal which confines the generalizability of the findings in national context. Secondly, the literature available on this subject is limited. Thirdly, interviews were conducted primarily with organizational stakeholders, creating a bias, but leaving scope for further studies to include the beneficiaries, i.e. community members. Lastly, though the multi-site approach facilitated data triangulation, the perspective of collecting longitudinal ethnographic data more intensely could have enhanced the study.

7. Conclusion

This paper sort to investigate the various ways in which Public Relations functions as an instrument for democratizing science communication within NCSM's outreach programs in West Bengal. The study was qualitative in nature, integrating case study, interviews, questionnaires and communication materials of

NCSM. Major activities like MSEs, folk theatre, puppetry and school-outreach programs were studied to understand how the organization utilizes storytelling for reaching the marginalized audience and empowering them. NCSM utilizes media framing to further reinforce its trust and legitimacy. The study also identified certain structural, institutional and communicative barriers like finance, distance, accessibility, shortage of manpower, weak feedback mechanism, etc., barring the marginalized communities from participating actively in the outreach programs organized by NCSM. Overall, the findings show that PR strategies must move beyond traditional media and embrace participatory communication grounded in two-way discourse, reciprocity and co-sharing with communities. Organizations should work on strengthening the feedback mechanisms, human resources and expanding media channels for as a crucial step towards this revolution. On successful implication, it will lead to the evolution of scalable and culturally-inclusive science communication practices in India.

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