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GMOs Science Communication in India: The Broken Link between the Scientist and the Society

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Abstract

India's engagement in science promotion activities is diversifying at an exponential rate. But the same does not hold true for popular science communication apart from the rampant debate in academic discourse. India's science promotion activities are happening primarily at the institutional levels with some need-based programs organized randomly. Despite witnessing phenomenal growth in mass communication and journalism in the past three decades, the growth trajectory of India's science communication is very limited. This poor science communication adversely affects the acceptance and progress of novel technologies like GMOs. There exists a lacuna in people's understanding of science, passion for science, and the diffusion of information about science in India. This paper evaluates the reasons for the unending controversy over GMOs in India through the perspective of science communication. An interdisciplinary methodology with a three-tier approach was adopted to study, evaluate and devise effective GMO science communication in India. The first tier dwells on various science communication models and their possible application in the Indian setup. Secondly, the existing science communication specifically governing GMOs in India is analyzed. Finally, the paper devises a Six Segmental Science (SSS) communication policy that would effectuate the growth and progress of novel technologies like GMOs. The SSS Communication Policy presents a cumulative, directional, and methodological approach to GMO Science Communication beginning with educating the masses followed by collecting their inputs and integrating it into our communication goals.

Keywords

GMOs, GMCs, Science Communication Policy, Science Literacy

1. Introduction

Science communication has become a standard item on science policy agendas in most countries with a modern science system. Governments around the world spend considerable sums of money on national programs (Weingart & Guenther, 2016). These programs serve several explicit functions like promoting scientific institutes, generating funds for research, and patenting new inventions. Ironically, such science communication schemes with vested interests are far from their real purpose of generating awareness, trust and popularising science among the masses (Besley, 2014). Various programs organized like seminars and science congresses cater to the intellectual populace only, leaving the masses far behind. Moreover, religious and cultural influences interfere with the novelties of science, making science communication tricky.

Under such a scenario, when an ambiguous technology like Genetic Engineering (GE) is introduced, it creates a social mayhem. Since their ingress in the Indian scientific corridors, GMO science communication has been at the mercy of biased media reports, aggressive NGO campaigns, and biotech giant propaganda. GE is an expensive technology in the hands of big multinational companies only (Kaur et al., 2012). Such a contentious issue backed by the rich lobby on one hand and non-scientific NGOs on the other is bound to cause ripples in society if not communicated properly. Sadly, it can't be said that GMOs have been poorly reported, instead these crops have been misreported, misrepresented, and misinterpreted. The presence of small groups of passionate stakeholders including Biotech MNCs and NGOs who present their biased approach through media has created a wider state of division among the public. Additionally, the media platforms that are meant to inform readers and listeners, frame these issues as battlegrounds of ideology, which intensifies controversy. Various social marketing campaigns to address controversies about the technology do not reflect the values of the larger public as they dwell on the wrong science-communication goal. Consequently, the general public because of inadequate awareness are confused and become victims of this avoidable controversy as was in the case of Bt Cotton, Bt Brinjal, and GM Mustard, different Genetically Modified Crops (GMCs) introduced or tried to introduce over the period of past two decades in India.

Bt Cotton, an insect-resistant GMC introduced in India in 2002, took the nation by storm. Published data shows that in the first few years of its introduction, numerous newspaper reports, and editorials were published in English dailies investigating the biosafety, environmental concerns, economic efficacy, and social viability of these crops on Indian soil. Amidst the reports of economic benefits from Bt Cotton, news of white fly, a secondary pest breakout, and the bollworm developing resistance covered headlines. The economic benefits claimed by the proponents of the technology were aggressively contested by the opponents who claimed that 80% of the research and development of commercial GMCs is held by private groups and few by the public sector (Kaur et al., 2012).

Therefore, these claimed economic benefits of GMCs do not extend to all segments of the society (Kaur et al., 2013). Ironically, after a decade of its release, Indian Agriculture Ministry Internal Advisory Report 2011 ascribed Bt Cotton for the current agricultural crisis and farmer suicides in the country. Consequently, the government decided to promote the cultivation of indigenous varieties of the crop. Adding another layer to the unending problem, a new variant of the crop, Herbicide Tolerant Bt cotton had been modified further to make the plant resistant to the herbicide glyphosate but was not approved by regulators. Adding to the problem a shocking revelation by the leading English daily reported that around 75 lakh packets of this new variant are in circulation in Maharashtra alone amounting to one-fifth of GM Cotton seed market (Das, 2022).

Bt Brinjal, India's first GM Food crop got intertwined in controversies right from the beginning. Following its approval by Genetic Engineering Approval Committee, a safety debate broke out in the country, further hyped by the media. As, the then Union Minister of Environment, Jairam Ramesh took the issue into the public domain, it was strongly opposed by various sections of the society. The scientific validity if any of the crop got gloomy in the various tainted communication reports. Consequently, a moratorium was put on its release on Feb 9, 2010, and in his decision, the minister appointed six premier academies to scrutinize the safety of Bt Brinjal and give a rigorous scientific opinion on GMCs. This Inter Academy report on GMCs when released declared Bt Brinjal safe. The very next day, Coalition for GM-free India, a popular NGO, highlighted malice in the above report terming it as a superficial overview without any critical analysis. The news of the Bt Brinjal section of the report to have been copied from a pro-GM newsletter of the Department of Biotechnology spread like wildfire. Poorly researched, and containing plagiarized sections, it had reflected badly on the science academies and was consequently withdrawn (Jayaraman, 2010). Later an updated report released was tidied up by adding references and details of the only meeting held on June 1, 2010, to discuss this crucial issue. The updated report was termed as scientifically invalid and socially sterile than the original one, by P.M. Bhargava, an expert nominated to the Genetic Engineering Approval Committee. With this GMC controversy, the amount of discontent and doubt in the minds of the common man has reached limits from where winning the trust would be even more difficult.

Consequently, the Supreme Court of India recommended an indefinite moratorium on field trials of GMCs till the government fixes regulatory and safety aspects and a ban on the introduction of GM varieties in regions of their origin. This ban on the field trials of any GMC was well thought out and much required (Chauhan, 2013). Years later to the Bt Brinjal controversy, in 2017, DMH 11 (Dhara Mustard Hybrid), a GM mustard was given a nod for commercial cultivation in the country. Scientists had made claims about the increased productivity of GM Mustard, but these claims were not fully supported by available scientific data. Subsequently, civil society organizations claimed that given the right inputs, some local varieties can produce the same amount of yield with lower farm costs than the GM varieties are expected to, without jeopardizing agricultural stability. Thus, in a parley of claims and counterclaims, DMH 11 never saw the day of light. Interestingly, a research briefing published in one of the most reputed science publishers put the onus of this failure on activists, media jingoism, and poor science communication (Jayaraman, 2017).

The above case study reflects that the mainstream media coverage of issues related to GMCs is alarmingly poor and limited in the country. The larger populations do not receive sufficient scientific data from the Indian laboratories and other scientific developments happening around the globe. It has been reported that science as a subject of human interests currently obtains only three percent of the total mass media coverage in India (Meyers et al., 2017). Despite mushrooming of institutions for promoting science and science education, publications of scientific materials have increased only marginally. Access to credible information on sciences is far from the desired standard. India has a huge appetite for political news and entertainment whereas, some serious issues pertaining to India's economy, poverty, health, medicine, agriculture, environment, science and technology, are either ignored or given little media space and time. Moreover, science writing, a relatively new field in India, requires proper pieces of training and skills in science and other related scientific matters. The lack of interest among the mainstream media on issues related to science and technology stems from the fact that science literacy has been limited to only the education sector, making it less popular among the masses. This has led to the loss of faith and misbeliefs among the masses especially when a novel technology like GMOs are introduced to the public.

2. Methodology

In this paper, an effort is made to study, evaluate and devise effective GMO science communication in India. The interdisciplinary methodology involving a three-tier approach adopted is as follows.

1) The Theoretical Premise: It involves an In-depth study of secondary data and empirical literature. The underlying theories governing science communication are analyzed for their application and adaptability to emerging new fields of science.

2) Current Science Communication Policy: Secondly, the existing science communication specifically governing GMOs in India is analyzed and assessed on the existing theoretical paradigms.

3) Six Segmental Science Communication Policy: A need-based GMO Science Communication Policy is recommended which would eliminate the unending controversy on GMOs and put it on the path to progress for the benefit of mankind.

3. Results

The three-tier analysis so devised was carried out for 22 months and step-wise results are reported hereby.

3.1. The Theoretical Premise

Science communication aims to enhance the public's understanding of science. It makes new advances in science visible and accessible to the public to allow people to make informed decisions about scientific issues concerning their own lives (Akin, 2017). It is supposed to secure ongoing political support for science, as well as to account for public expenditure on science, thus fulfilling a democratic obligation. Therefore, science communication not only promotes science but also science organizations.

Theorists describe how science has been communicated and shall be communicated through different models. Three basic models of science communication well documented in the literature are Deficit Model, Dialogue Model, and Participatory Model. Under the deficit model, science communication is driven by the perceived need by scientists and scientific institutions for science literacy, where the public is seen as empty vessels needing to be educated with scientific knowledge (Nisbet & Scheufele, 2009). In this model, science communicators view the public as having a "deficit" of scientific knowledge until this is received in some form through dissemination or education (Sánchez-Mora, 2016).

In Dialogue Model, science communication follows a two-way process. It presents a broader perspective with three key elements. Firstly, science communication engages a dialogue with the public to help explain the science (Dietz, 2013). Secondly, science communicators and scientists are prepared to listen to and consult the public about their perceptions, concerns, and needs concerning science (Druckman & Lupia, 2017). The public concerns and needs are acknowledged under this model. And finally, the information gathered from the public is recognized as valuable input in scientific progress and policymaking.

The third model, the Participatory model of science communication recognizes the public as being equal with scientists and policymakers in reflecting upon, sharing knowledge about, creating new knowledge, and making decisions about science that affects society (Bubela et al., 2009). The participatory model signals a more obvious shift in power than the dialogue model: from the scientists to the public. It also emphasizes, even more than the dialogue model, the role of policymakers as important actors in the democratization of science (Fahnrich, 2018).

The traditional means of transferring knowledge from scientists to various publics, generally through publications, lectures, and exhibitions, has long been questioned by those researching science communication as depicted in the Deficit model (Weingart & Guenther, 2016). Thus, the Dialogue and Participatory models are found to be more effective. Although many theorists dispute the distinction between the dialogue and participation models, as both are more deliberative models of communication as they seek to involve the public on a more democratic basis with the science, whether this be through a consultation or joint problem-solving.

The three basic models of science communication apply to GMOs with the need to shift from Deficit to a Participatory model. But GMO science communication has a very crucial aspect to it; the inherent uncertainty in the field of Genetic Engineering (GE). Although uncertainty is inherent to science and science communication in the case of a novel field of GE it is even more pronounced. The current understanding of this technology is modest because of the vastness of the gene pool and diverse unexplored genomes. The release of any genetically modified organism (GMO) into the environment is fraught with lots of perils. Especially in the case of Genetically Modified Crops (GMCs), their effect on ecology, environment, health, ethics, economy, and society as a whole has led to perplexing debate.

Portraying uncertainty in science communication could have both positive and negative effects (Winter et al., 2015). Given the importance of science communication in society, it is crucial to determine the effects of portraying uncertainty about science. Some research suggests that communicating uncertainty about science will instigate, perpetuate, or exacerbate more negative attitudes toward scientists and their claims (Kahan, 2017). It is important to understand that in the case of science communication, people expect the scientists to be precise and confident because as a layman they do not understand the role of uncertainty in science. Thus, the theoretical models of science communication studied here do not consider the uncertainty factor. Although the scientific community calls for more interactive and deliberative communication where scientists more actively engage with the public but the scientists and the communicators fail to address the uncertainty confidently as a crucial aspect of new developing streams of science (Chang, 2012).

3.2. Current Science Communication Policy

India has an impressive scientific heritage showing rapid progress over decades. However, a remarkable gap has persisted between this scientific knowledge and the common man and until recently, almost no effort has been made to bridge this gap. Although, for the past two decades, science communication activities have gained momentum in India. In this section efficacy of existing science communication policies and models would be studied. Boosting and upgrading the public understanding of science has been on the agenda of many government and non-government organizations. Efforts are being made to develop a scientific culture that can penetrate India's socio-culturally diverse society, developing a scientifically aware and critically thinking nation.

The National Institute of Science Communication (NISCOM) publishes the Hindi popular science journal *Vigyan Pragati* (Progress in Science), the Science Reporter (an English monthly), and *Science Ki Dunia* (an Urdu quarterly) in addition to 11 professional scientific journals and various popular science books. The National Council for Science and Technology Communication was established under India's sixth Five-Year Plan providing much-needed impetus to science communication in the country (NCSTC, 2022). The Council aims to integrate, systematize, and actuate science popularisation and communication, at the micro as well as macro level. Various programs of the council include training in science and technology communication, creating information networks and databases along with promoting research and field-based projects in the area. Vigyan Prasar, an independent organization of the Department of Science and Technology, also plays an important role to coordinate efforts among various scientific institutions, educational and academic bodies, laboratories, and industry for the effective exchange and dissemination of scientific information.

In India, various modes of science communication have been in use to reach out to the masses like print and audio-visual media. Apart from research publications, mass media mediums including several national and regional daily newspapers produce weekly science pages. In addition, numerous science-based programs are aired on All India Radio (AIR), like Science Today, Science Magazine, Science News, and Radioscope (NOSTC, 2022). Television channels also broadcast programs like Doordarshan Science, and Turning Point to popularize science among the masses. Additionally, the organization of science fairs, exhibitions, demonstrations and tours by private, government, or industry as well as the development of interactive digital software improves the scientific acumen of the masses. Although, information technology has given birth to a comparatively new form of interactive science communication which could prove to be an effective way to illustrate difficult scientific concepts as well as make them easily accessible. Ironically, it is reported that the interest of the common man in science communication is waning irrespective of the digital revolution. Surprisingly, popular Indian science magazines like Science Today and Bulletin of Sciences and Indian editions of certain foreign magazines, such as *La Recherche* and *Scientific American* have been discontinued.

In GMO research, India is one of the first countries to have a separate Department for Biotechnology. The Department of Biotechnology mandates the research, development, and large-scale use of biotechnology and its products. Ironically, the department has no directive on GMO science communication and engagement. Although the department cites creating biotechnology as a premier precision tool of the future for the creation of wealth while ensuring social justice, it has weak science engagement or communication policy. The only science communication and outreach programs driven by the department are the multiple digital publications of its programs, initiatives, and reports with one-way communication.

Sadly, in today's times, science fails to captivate the interest of mass media. It is rarely reported as a lead story because editors and reporters do not consider it to be news in the normal sense (Bubela et al., 2009). Therefore science news accounts for just three percent of coverage by India's mass media. There is no doubt that scientific information is becoming an essential and integral part of people's daily lives. Present and future science communication efforts have great potential in shaping the lives of people and making their decisions more informative and rational.

However, illiteracy and ignorance are major challenges. While literacy levels in the country are increasing, scientific literacy is still drastically low.

Given India's large population, limited resources, and a multitude of languages, mass science education is very challenging. Although, there have been efforts to popularise science by integrating and presenting it in the 18 regional languages by translating some scientific publications, and certain television and radio programs into vernaculars (Barath, 2019). But it falls short considering the lingual diversity of the country, as much of the population still misses out on science communication efforts. The initiatives by radio and television in this direction are encouraging with special channels on science and technology, and other channels featuring scientific discussions and interviews of scientists about their research, but not satisfactory as far as science communication is concerned.

The above study of India's science communication policy fails on multiple levels. Failing the key tenet of communication which is to reach the audience, the entire science communication premise of India is based on the deficit model. Print media in the form of journals, magazines, and newspapers are neither easily accessible nor comprehensible for the general public. The charm and variety of satellite television and digital media have marred the chances of audio-visual science programs run by government agencies as their number continuously dwindles. The science communication of India comes out to be poor with no interaction or participation of the common man.

3.3. Six Segmental Science Communication Policy

There is an urgent need to make science communication activities more effective, both in terms of quality and quantity. It is the obligation of both the scientific community and communicators to make a dent in wiping out controversies surrounding GMOs (Boschetti et al. 2016). Science communication activities must be conducted and governed in a systematically planned manner, under one umbrella organization, and according to a properly defined national policy. Although, the NCSTC Network started in 1991 to spread science popularisation activities throughout the country, engaging in science is still not a common man's cup of tea. Under this council, a nationwide project to compile information on science communication software, hardware, and agencies to facilitate further networking has only helped in data assimilation and not the popularisation of science. It is clear that the formation of networks of organizations and data assimilation alone is not sufficient. The need is to develop an implicit and efficient mechanism to ensure effective science engagement and communication in a more cohesive manner, which is currently lacking.

An exhaustive framework for science communication must be reframed with maximum participation of the public to improve science literacy and science engagement in public. A mechanism with a broad-based and comprehensive approach to developing a strong science communication network with special consideration for the upcoming technology-driven inventions like GMOs is proposed here. The Six Segmental Science (SSS) communication policy has a cumulative, directional, and methodological approach in GMO Science Communication (See Figure 1). It will encompass six essential stages in creating a strong science communication network as explained below.

1) Improving Science Literacy

Science literacy stands on four pillars; Knowledge of the basic facts of science, Understanding the methods of science by questioning, experimenting, observing, and drawing inferences, appreciation of the positive results after scientific experiments, and rejecting unconquered beliefs (Hendriks et al., 2016). Such literacy drives could be very helpful, especially in the case of GMOs, which have been marred in controversy right from the beginning. Lack of basic information from a verified source fumes the doubts leading to misbeliefs and apprehensions as was seen in the case of GMOs in India (Muller, 2019). Efforts were never made to generate literacy on genetic modification in the country so that it reached every individual in an easily comprehensible form. The posters and brochures of DBT in English restricted to internet access fail to generate any awareness in a country of 1.8 billion who speak 22 different languages.

Against this backdrop, Science literacy in India is crucial and a primary step to achieving efficient science communication. As science evolves with every passing day, limiting science literacy to the education sector will withhold the knowledge only to the current generation ignoring the older generations and the major populace. Thus, it should be part of government, non-government, and departmental outreach programs. Literacy programs in the local language should use popular and more entertaining formats like street plays, folk songs, folklore, science cinema involving local people, and local art forms. This could prove very

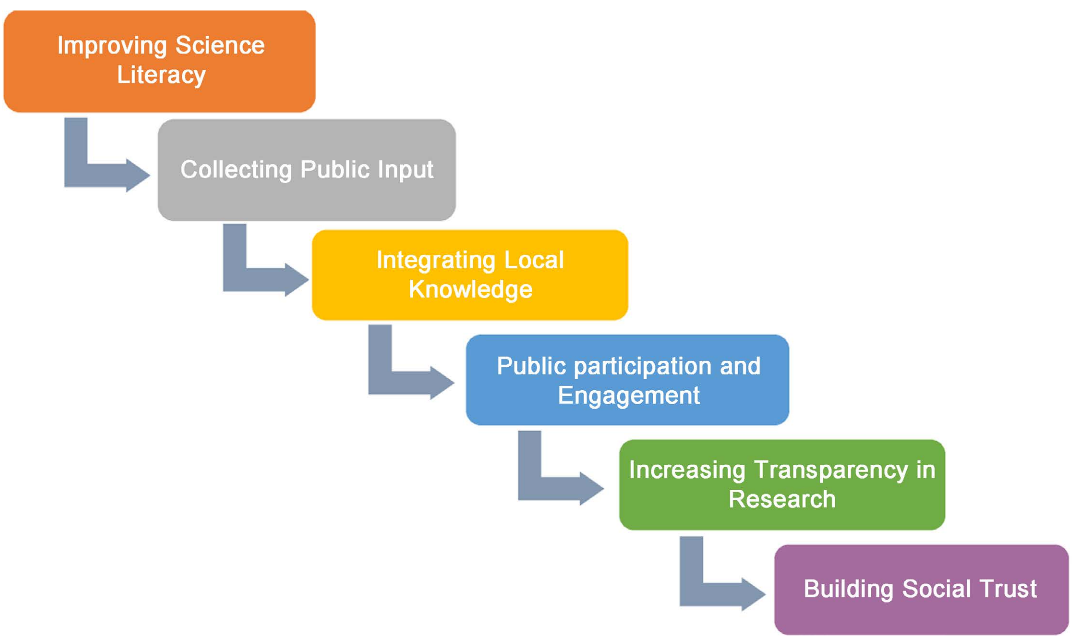

Figure 1. Six Segmental Science (SSS) Communication Policy.

helpful in creating awareness among illiterates or the newly literate. In this way, superstitions could be removed from society creating a scientific environment at the grassroots level.

The literacy drives could help in achieving an increase in the number of people who hold accurate beliefs about new scientific findings, scientific facts, scientific methods, possibilities and limitations of science, and the risk associated with scientific endeavors (Bucchi, 2014). Thus, it aims to improve the population's beliefs about science along with reducing the number of false beliefs, increasing the number of true beliefs, and increasing the number of people who have correct beliefs, or one can aim for specific distributions of these improvements.

2) Collecting Public Inputs

Only a science-literate society would be in a position to comprehend the scientific initiatives of governments and scientists and comment on them. The scientific experts are completely focused on the empirical and experimental aspects of their research area, ignoring moral, social, and ethical concerns. They have a narrow view vis-à-vis citizens on social and ethical concerns of scientific research or its application (Jensen & Holliman, 2016). Therefore, it is important to collect the citizens' views on what research aims and applications of science should be pursued so that it is need-based and benefits mankind. In the case of GMCs, inputs from all the stakeholders must be collected on the preferred type, trait, and crop of genetic modification. It has been reported that collecting public inputs could also contribute to their generating trust in science and scientific endeavors and could prove instrumental in generating social acceptance (Russell, 2013). Thus, it necessitates multi-way communication where public views have to be considered by decision-makers.

3) Integrating Local Knowledge

Collecting and making use of knowledge from various stakeholders improves the efficiency of communication. The local knowledge collected from citizens may act as important correctives to scientific views and make them easily comprehensible, as members of the public may have insights about problems, issues, and solutions which even experts miss (van der Bles et al., 2019). This aspect was ignored in the propagation of GMCs in India. Powered by MNCs a scurry of GMCs into India took people by surprise. Consequently, the traits and type of genetic modification of introduced GMCs are not need-based and do not fit well with the Indian Agricultural setup. Genetic modification of crops should be need-based and carried forward only after discussions with the farming community so that its benefits extend to all segments of society and not just a few biotech MNCs. The key is to collect and integrate the local knowledge, requirements, and indigenous practices with the scientific communication process for the benefit of the scientist as well as society. It will help to improve the quality of scientific knowledge as well as activities informed by science.

4) Public Participation and Engagement

Good science communication ensures that the public engages with and understands relevant scientific research. It involves using a wide variety of communication tools for engaging the public, including non-technical audiences and policymakers. An evolved culture of science that promotes public science engagement by dismantling knowledge hierarchies and helps us all to make better sense of the world would require effective communication and innovative engagement practices at its core (Meyers et al., 2017). Public engagement activities including discussion forums, outreach programs, and community science clubs and competitions have been used for a long but failed to generate interest and awareness. Nowadays, social media has evolved as a popular platform for science engagement. Public engagement and communication of science via social media consist of an approach that employs multiple connected platforms. Social media are inherently interactive. Sharing content can initiate discussions and lead users to want to build relationships, but there need to be content connecting individuals on these platforms. Such interactions could be very useful in the case of contentious issues like GMOs, where a user can interact directly with the policymaker or the scientist to clear any doubts. Moreover, the speed of conversations on various social media differs from offline, as these platforms can facilitate real-time discussion of issues while other, offline slower-paced platforms, demand less immediate attention and take more time. Scientists often identify time constraints as a barrier to public engagement activities but social media facilitates the same in much less time (Besley, 2014). Moreover, debates on social media frequently consist of more than two users. The ability to involve other experts and communicators in a discussion further reduces the burden of individual users.

5) Transparency in Science Research and Funding

This is a crucial stage of science communication policy as it helps in enhancing the democratic legitimacy of decisions regarding funding, governance, and application of science or specific parts of science (Peter, 2017). To generate broad social acceptance and political support over a scientific endeavor transparency in research funding and democratic decisions regarding funding, governance and its application are a must. All such initiatives must be brought to public knowledge and suggestions must be invited. The problem arises when commercial viability and interest are merged in research funding ignoring and eroding its societal value as was in the case of GM Crops. A renewed approach to need-based and public-sponsored research in GMOs can reverse the trend and set it on the path to progress.

6) Building Social Acceptance and Moral Trust

Consequently, a step-wise approach to science communication integrating all the aspects discussed above leads to a better social acceptance of novel technologies and building moral trust which will further promote research in these fields. Generating social acceptance of science as a whole or a certain part of science entails better funding, governance, and application of science (Fiske & Dupree, 2014). This will further aid in building epistemic trust in scientific institutions as well as their research. The sixth stage of this policy is the most important and difficult about GMOs and their unending controversy. A renewed approach to research, communicated methodically following the ideal science communication policy can help in regaining the public trust and confidence in GMOs in the country.

The hierarchy of the six stages of science communication policy discussed above is the key to the whole communication process, where we begin with educating the masses followed by collecting their input and integrating it into our communication goals. The new approach to science communication is increased participation of the masses to win their confidence. Most importantly the scientific results must always be communicated honestly and described in simple language without concealing any facts and uncertainty which is inherent to biotechnology. Thus, a multi-prolonged strategy is required to make science communication more effective and to address obstacles associated with it. Scientists should be trained in the art of science communication while journalists must be oriented towards at least the basic understanding of sciences and their methodology (Nadelson et al., 2014). The issue of professional dialects and departmentalism is a serious problem that must be fixed strategically to enhance the free flow of scientific information to the non-scientific community. More platforms should be created to engage scientists and media practitioners to have close dialogues on issues pertaining to scientific developments. When the journalists and the scientific community exchange communication on issues related to science, it creates a mutual understanding, which in turn yield positive outcome. More seriously planned agendas and policies for science communication in a truly transparent manner are pre-requisite to engage and speed up science communication. While transmission of information remains important, the challenge remains to develop transaction modes of science communication.

4. Conclusion

The scientifically awakened society of our dreams is not inaccessible. Rather, it is achievable with technologies available today, but with better utilization to carry scientific messages to the people. The presentation of scientific information in the media needs to undergo a metamorphosis, with a new generation of science writers and journalists presenting scientific advancements interestingly and innovatively. The use of social media could lead to a better exchange of information on scientific research and developments. Moreover, if science communication has to penetrate the masses throughout our country, it needs to break the largely self-imposed barriers of language and geography.

Topics like GMOs that lie at the intersection of science and society are crucial for a multidirectional engagement at a time when scientific and technological breakthroughs have wide-range impacts on everyone in our world. These societal issues, along with the fractured and polarized nature of public discourse, create a clear need for multidirectional learning between and among the public and scientists (Fahnrich et al., 2020). Therefore, the proposed framework on science communication in this paper effectuates all the stages of communication into winning public trust and confidence. It assigns utmost importance to generate societal interest as well as plays an important role in connecting communities with researchers and scientists and not alienating them. Science engagement of the masses also aids in integrating their feedback so that future products of science and technology reflect the priorities and concerns of a diverse and engaged public. No technology is error-free. Engaging the public, communicating certainty, and encompassing socio-cultural aspects could lead to its growth and progress for posterity.

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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