

## **Chapter 1**

### **Introduction and Overview**

#### **1.1. Background**

Science and Technology (S&T) have penetrated deep into the daily life of modern society. With exponential advances in S&T having societal, cultural, economic, developmental, and ecological implications, our life is increasingly becoming driven by, and dependent on, S&T. The impact of S&T on modern society is so high that it cannot be ignored. S&T advances can be both beneficial and harmful to human society. Such a situation necessitates building a basic understanding and critical appreciation of science in society at the grassroots level to extract the benefits of S&T and to safeguard against its potential harms. Here, careful, effective, and efficient utilisation of S&T can benefit our society and contribute to societal upliftment, national development, problem-solving, lifestyle changes, and optimal utilisation of resources. Many of the problems faced by modern society and the social evils such as myths, blind faiths and superstitions find their place in our society mainly due to scientific ignorance. These can be solved with proper scientific and technological interventions. Therefore, there is a need to take the benefits of knowing science down to the grassroots level. Making scientific temper, scientific method of enquiry, and scientific culture an integral part of the daily life of every citizen can ensure holistic growth of society.

The chasm between science and society is widening, which is further augmented with the institutionalisation of science. There exists a communication gap between science and society. This gap deprives society of the potential benefits of scientific knowledge. Scholars and other stakeholders have realised and emphasised the need for enhanced dialogue between science and society in the recent past. In this dialogue between science and society, scientists

are increasingly being asked to play an active role in science communication and public engagement. Such voices are coming from a variety of stakeholders. However, what scientists think about their active engagement in science communication remains elusive in many parts of the world, including India. With no substantial studies on this topic existing in India, it is a challenge to take up this research to explore and document what Indian scientists think about science communication with the general public, their engagement, and its impact on their careers. This chapter briefly presents the inception and execution of the present study. It provides an overview of science communication, science communication by scientists, background to the present study, the problem, research objectives, research methodology, and thesis structure.

## **1.2. Science Communication**

Science Communication is an emerging area of academic and professional expertise (Davis, 2010; Pitrelli, 2010; Priest, 2010; Trench & Bucchi, 2010; Trench, 2012; Rajput, 2017). Its professional part focuses on communicating science and scientific practices to the general public through appropriate interventions for ensuring active public engagement and two-way dialogue between science and society. The academic part involves university courses (undergraduate and postgraduate) for capacity building and human resource development in the area of science communication and doctoral and post-doctoral level research for better understanding the nitty-gritty of science and society interactions, impact and effectiveness of science communication activities, perceptions and attitudes, behaviour studies, engagement and performance, policy studies, science communication and good governance, and evaluation and impact assessment studies. Science communication is broadly categorized into two types: 1) science communication among the peers (specialists) only and 2) science communication between the peers and the public *i.e.*, between specialists and non-specialists.

Science communication among peers has always existed since the enterprise of science as an organised activity started. As this communication is generally in the specialised technical language (jargon), it is also known as technical science communication. Such communications are largely beyond the comprehension of the general public. The second type of science communication, *i.e.*, between scientists and the public, which has remained largely ignored, started getting attention recently since the early 1980s. It tries to establish a communication bridge between science and society by reducing the knowledge and linguistic barriers between scientists and the public. It is an effort to communicate science to the public in the language they understand and appreciate. Therefore, it is also known as the public communication of science or popular science communication. In this research, the term science communication is used for the communication of science with society or the public. Therefore, the terms science communication, public communication of science, public science communication, public understanding of science, and public engagement will be used interchangeably in this thesis.

With the rapid advances and developments in the field, science communication or public communication of science recently started getting recognised as an important area in the scientific world (Royal Society, 1985; Balaram, 2002; Massarani & Moreira, 2004; Bubela et al., 2009). Science communication is increasingly gaining momentum globally as an interdisciplinary and multi-disciplinary area of academic and professional expertise (Gascoigne et al., 2010; Pitrelli, 2010; Priest, 2010; Trench & Bucchi, 2010; Rajput, 2017). Its existence is drawn from different subjects like communication studies, mass communication, journalism, science, sociology, psychology, philosophy, history and political science, while it goes on building its own structure, processes, theories and approaches. Over the past few decades, science communication has become a discipline of its own right and continues to evolve its

theory and practices. It has its own peer-reviewed research journals, national and international conferences, university departments with teaching and research programmes and professional/academic science communication societies (Bowater & Yeoman, 2013).

Communication of science by scientists to the public may not be a new phenomenon (Bowater & Yeoman, 2013), as many scientists such as Michel Faraday, Humphrey Davy, and T.H. Huxley were popularising science to the public a few centuries ago (Salwi, 2002a; Massarani & Moreira, 2004; Bowater & Yeoman, 2013). However, in modern times, science communication as an organised activity got much impetus in the early 1980s with the mobilization of the ‘public understanding of science’ movement in the West (Royal Society, 1985; Miller, 2001; Massarani & Moreira, 2004; Mulder, Longnecker & Davis, 2008). In the West, this movement caught more attention with the publication of the ‘Public Understanding of Science’ report that emphasised the urgency of improving the general level of public understanding of science through concerted efforts by different stakeholders, including scientists and scientific institutions, with demand for more science in the media, especially newspapers (Royal Society, 1985). Meanwhile, recognising its importance, many of UNESCO’s 165 member states placed science popularisation high on their list of priorities (Spurgeon, 1987).

Initially, the public communication of science started with the assumption that there is a deficit of scientific knowledge among the general public, requiring consistent efforts to inform and educate the public for bridging the knowledge gap between science and society. In the absence of scientific knowledge, the public may develop fears and distrust toward science. Such fears and lack of trust may translate into anti-science sentiments or even anti-science movements. Also, many in the scientific world and the media believed that the public

is not interested in science. The public may not be familiar with the scientific jargon, which is often seen as a repellent for many to engage with science. All the public may also not be interested in the nitty-gritty of every scientific topic but would generally be interested in knowing a bigger picture of the scientific enquiry (Davis, 2010). With this viewpoint, science communication can be seen as a vehicle to take the fruits of science to the non-specialist public. This cannot be achieved without translating the scientific knowledge from the technical jargon into the easily understandable every day (non-technical) language of the audience (Manzini, 2003; Davis, 2010; Tsabari & Lewenstein, 2013; Grillo et al., 2016). It requires a two-way dialogue (Bubela et al., 2009) and some mediation for sharing and disseminating scientific knowledge from the experts to the non-experts (Grillo et al., 2016). Therefore, much of the science communication is seen as the activities of professional science communicators (journalists, reporters, public information officers, writers, storytellers, filmmakers, broadcasters, scientists, etc.) (Treise & Weigold, 2002).

The popular mass media (newspapers, TV, the radio, books, internet, films, etc.) are the main sources of scientific information for the general public (Nelkin, 1995; Wellcome Trust, 2001; Weigold, 2001; Lundy, Ruth, Telg & Irani, 2006). However, science coverage in the media has always remained to be low (Salwi, 2002a; Patairiya, 2002; Patairiya, 2003; Besley & Nisbet, 2013; Dutt & Garg, 2000; Gregory, 2003; Arulchelvan, 2010; Nautiyal, 2010; Kumar, 2013; Peters, 2013; Merino & Navarro, 2019). In India, science coverage in the print media is reported to be less than 3% (Patairiya, 2002; Kumar, 2013). In addition to efforts to increase the coverage of science in the media, a wide range of activities are being carried out around the world to communicate science to the public. Different media, channels, formats, and platforms of mass communication (folk, print, electronic and digital) are being used to spread the message of science (Pitiporntapin, 2013).

In the history of science communication, the deficit model has dominated the communication landscape (Dornan, 1990; Wynne, 1991). However, there is an increasing concern that this one-way and top-down approach may not always be helpful as one size may not fit for all. Mere disseminating scientific knowledge may not always work for a heterogeneous audience of varying lingual, social, cultural, economic, and religious contexts (Sturgis & Allum, 2004; Davies, 2008), especially in the multicultural and multilingual Indian society. Some scholars argue that science communication requires a two-way dialogue after duly considering the knowledge, requirements, desires, attitudes, and cultural context of the public (*e.g.*, Massarani & Moreira, 2004; Burns, O'Connor & Stocklmayer, 2003; Gregory, 2003). While the deficit model is still relevant in certain situations, the field has seen an evolution of a variety of models (Brossard & Lewenstein, 2010), *e.g.*, contextual model, lay expertise model, public engagement and participation model, and other two-way communication approaches including expos, exhibitions, science cafes, amusements parks, science museums, and science centres. Ultimately, all these models and approaches try to reduce the deficit between science and society and add to the public awareness of science (PAS), which if pursued consistently and continuously may lead to public understanding of science (PUS). When people have a fair understanding of science, they tend to engage in science activities, and such engagements may lead to public participation in science, its propagation, and policymaking.

To better understand public communication of science, several studies have been conducted on different aspects of science communication over the past more than 30 years (*e.g.*, Wellcome Trust, 2001; Royal Society, 2006; Nielsen, Kjaer & Dahlgaard, 2007; Davies, 2008; Martin-Sempere, Garzon-Garcia & Rey-Rocha, 2008; Kreimer, Levin & Jensen, 2011;

Ecklund, James & Lincoln, 2012; Besley & Nisbet, 2013; Guerrero, 2016; Loroño-Leturiondo & Davies, 2018; Merino & Navarro, 2019; Ho, Looi & Goh, 2020; Valinciute, 2020). Several studies have focused on science coverage in different media, content analysis, the role of media persons, public perceptions and attitudes to science in general or specific science subjects (nanotechnology, agriculture, space science, or climate change), science controversies, assessment of communication skills and attitudes of scientists. Such a volume of research on various aspects of science communication has established it as a new and fast emerging area of scientific expertise.

### **1.3. Scientists as science communicators**

Over the years, different voices have been raised for active participation of scientists in informing, educating, and engaging different publics (the general public, policy makers, media, students, etc.) about the advancements in science and technology (Royal Society, 1985; Wellcome Trust, 2001; Royal Society, 2006; Nisbet & Scheufele, 2009; Rajput, 2009; Agre & Leshner, 2010; Nautiyal, 2010; Shugart and Racaniello, 2015; Dudo & Besley, 2016). Many studies and surveys in different countries have been conducted to understand what scientists think about science communication, the publics, and their own engagement. Scientists generally do not regard public communication of science well because such efforts are often not legitimized, recognized, or rewarded by the scientific community or by the R&D institutions as employers (Gascoigne & Metcalfe, 1997; Andrews et al., 2005; Poliakoff & Webb, 2007; Jensen et al., 2008; Kim & Fortner, 2008; Martin-Sempere, Garzon-Garcia & Rey-Rocha, 2008; Shanley & Lopez, 2009; Valinciute, 2020). So, they see it as less rewarding than the peer-reviewed publications for their career progression. Many scientists do not see any personal or professional benefits in communicating research to the public (Wellcome Trust, 2001; Jensen, Rouquier, Kreimer & Croissant, 2008; Poliakoff & Webb,

2007; Shanley & López, 2009; Jensen, 2011; Agnella et al., 2012). Scientists involved in science communication activities are often not encouraged by colleagues, and those who engage in such activities are often labelled as ‘publicists’ (Royal Society, 2006; Martín-Sempere, Garzón-García & Rey-Rocha, 2008; Shugart & Racaniello, 2015; Ecklund, James & Lincoln, 2012;). Different studies suggest that scientific communities generally discourage scientists from engaging with the media, considering public engagement can potentially damage their academic reputation (Porter et al., 2012; Peters, 2013; Watermeyer, 2015). Such a perception may be attributed to the lack of control over the communication process in the media (Peters, 2013), resulting in misreporting, misquoting, misinterpretations, or factual inaccuracies (Gascoigne & Metcalfe, 1997; Wellcome Trust, 2001; Merino & Navarro, 2019).

However, several studies (Wellcome Trust, 2001; Conradie, 2004; Royal Society, 2006; Lundy et al., 2006; Searle, 2011; AAAS, 2015; Hamlyn et al., 2015; Farahi et al., 2019; Llorente et al., 2019; Merino & Navarro, 2019) have stressed on the imperative need for scientists to consider science communication as their moral duty or professional responsibility and so to contribute actively to enhancing public understanding of science. These studies suggest that scientists are instrumental in communicating science to the general public because they are the creators of scientific knowledge. Further, who else knows science better than scientists. Peters (2013) also sees scientist’s interaction with the media as part of the modern scientist’s role and recommends that ‘talking to the media’ be a part of the professional life of scientists (Peters, 2013).

Several studies have attempted to understand what scientists think about science communication to the public (*e.g.*, Mathews, Kalfoglou & Hudson, 2005; Pitrelli, Brunelli &



Murellia, 2006; Royal Society, 2006; Thompson et al., 2009; Searle, 2011). Interestingly, some recent studies have reported positive tendencies among scientists about science communication. For example, a survey of UK scientists revealed that most of them (around 97%) believe that a greater understanding of science is beneficial to the public in helping them make more informed decisions about their lives and understanding what scientists do in their labs (Wellcome Trust, 2001). This stand is further strengthened when the Royal Society's study (Royal Society, 2006) suggests that communication of research results can significantly influence the public's views, attitudes, and behaviour.

When these studies signal for a more significant role of scientists in the public communication of science, scientists may have their own reasons for non-engagement or may face barriers and impediments in their active involvement. Therefore, several studies suggest that offering personal benefits to scientists and removing the potential barriers in their engagement would increase their involvement in science communication activities (Gascoigne & Metcalfe, 1997; Andrews et al., 2005; Royal Society, 2006; Yuan et al., 2017; Farahi et al., 2019; Ho, Looi and Goh, 2020; Rose, Markowitz & Brossard, 2020). Other studies recommend training scientists in science communication skills (Royal Society, 2006; Varner, 2014; Lisa Katic, 2015) to build their confidence in effectively engaging with the public and making it personally meaningful to them (e.g., Varner, 2014). However, such studies exploring scientists' perceptions, attitudes, behaviour, practices, and engagement in public communication of science in the Indian context are scarce and elusive. We do not know much about what Indian scientists think about science communication and their own public engagement.

#### **1.4. Constitutional and science policy background to the study**

In India, the importance of cultivating science, inculcating a scientific temper, and *taking* the benefits of scientific knowledge to the larger society have been recognised at the highest levels in all the four science and technology related policy documents of the Government of India and even in her constitution. To transform India's socio-culturally diverse society into a nation of scientifically thinking and scientifically aware people, the constitution of India expects every citizen '*to develop the scientific temper, humanism and spirit of enquiry and reform*' as a fundamental duty of a citizen under the part-IV of the Indian Constitution, Article 51A(h).

In addition to this constitutional provision, the Government of India's first science-related policy, Scientific Policy Resolution 1958, emphasised the cultivation of science and scientific research in all its aspects; recognition of scientists' work as an important component of the strength of the nation; encouragement of individual initiative for the acquisition and dissemination of knowledge; and taking all the benefits of scientific knowledge to the people of the country. One of the aims of the second policy – Technology Policy Statement 1983 – is “to ensure that our available natural endowments, especially human resources, are optimally utilized for a continuing increase in the well-being of all sections of our people.” Like the previous two science policies, the third policy – Science and Technology Policy 2003 – also lays much emphasis on taking the message of science to the people, advancing scientific temper among them, and calling them all to contribute to S&T advancement and use it on a large scale for human welfare. The fourth Indian policy on science – Science Technology and Innovation (STI) Policy 2013 – also reiterates the need to promote the spread of scientific

temper and scientific knowledge amongst all sections of society to enhance public understanding of science in society.

This way, India is possibly the only country in the world with a constitutional requirement of a fundamental duty for every citizen to develop scientific temper and spirit of enquiry. This constitutional requirement is a tremendous possibility for the government to promote science and scientific temper among the Indian masses. Despite these constitutional and policy provisions, the state of affairs in science communication in India has remained unsatisfactory. The condition is even worse in the case of academic research in science communication in the country. Such constitutional and policy provisions could have resulted in establishing the best possible institutions, mechanisms, and systems for science communication in India that could have been trendsetters for the entire world. The scientific community in India could have leveraged these provisions to make public communication of science as one of the top priorities of the scientific establishment in India. However, they have miserably failed to capture this brilliant opportunity.

Although several institutions like Vigyan Prasar, CSIR-NISCAIR, National Council of Science Museums (NCSM), and National Council of S&T Communication (NCSTC) have been established for promoting and popularising science among the masses, India has missed the opportunity for nurturing scholarly research in science communication. Keeping in view the socio-cultural, linguistic, religious, and economic diversity in our society, any science popularisation efforts to be practical need to be backed by a substantial body of research on the various aspects of science communication in the Indian context.

Here, in the global backdrop of demands for enhanced and active involvement of scientists in public engagement activities, we do not know what our scientists think about this new role and responsibility being thrown upon them. We also do not know much about whether they are willing to engage with the public and having enough skills to act as public communicators of science. How will such engagement impact the career and professional life of scientists? Many such questions need to be answered before entrusting the job of science communication to scientists. Addressing these questions further becomes more pertinent with the present dispensation at the Central Government of India increasingly and repeatedly demanding the scientific institutions to showcase their R&D activities and achievements to the public, and the individual scientists to engage more with the public (DST, 2017; PIB, 2017a; PIB, 2017b; Rajput, 2018).

### **1.5. The Problem**

The knowledge gap between science producers (scientists) and the beneficiaries of such knowledge (public) is increasing day by day. Accordingly, new classes – ‘Science Rich’ and ‘Science Poor’ – are emerging and getting established in our society. One of the primary reasons behind the chasm existing between scientists and the public is the absence of a ‘language’ appreciated by both parties; scientists generally do not talk in layman’s language, and the public does not understand the technical jargon scientists used in scientific publications. Furthermore, scientists are generally hesitant to interact with the media, citing various reasons such as lack of time, less/no incentives, institutional restrictions, and deviation from research. The media people also have their limitations, most journalists/editors have no science background, and the gatekeeping for news in the media houses renders science news less important and less sellable. Journalists/communicators often blame scientists for being poor communicators and non-cooperative, and scientists also blame

journalists for misreporting, misquoting, factual inaccuracies, and sensationalising issues. In this context, it should be remembered that communicating science among the public faces many challenges, and in a diversified country like India, these are further multiplied. Also, many policy issues related to science education and science communication need urgent redressal in this nation.

In the process of public communication of science (dialogue with society), scientists are considered key actors. They can be the information sources for media persons/journalists, information validators for media, mediators between science and society, or themselves as public communicators of science. Several studies in the different parts of the world (especially in the West and Europe) have emphasised the need for the active involvement of scientists in science outreach and engagement activities with the public. However, studies on science communication by scientists in the Indian context are very rare. Various aspects of science communication from scientists' perspectives remain unexplored in the Indian context.

India is home to thousands of R&D centres (DST-NSTMIS, 2018), but scholarship in science communication in India has remained at its infancy stage (Rajput, 2017). Especially, no significant studies on science communication from the perspectives of scientists in the Indian context are known to exist. What scientists think about science communication and its importance and their involvement in such activities, their current engagement practices, and the impact of such engagement on their career advancement remain unexplored in India. Such a lack of understanding of how scientists in India make sense of the complexities of science communication with the general public and the media would only impede scientists' public engagement. Therefore, the present study aims to provide empirical evidence and some baseline data on public engagement by scientists in India.

## **1.6. Aim and objectives of the research**

This study explores what Indian scientists think about the importance of science communication, their roles and responsibilities, their engagement and factors affecting their engagement, its impact on their career advancement, and attempts to identify the possible interventions for further enhancement. Even new science policies in India are mandating science communication as a social scientific responsibility of scientists and scientific institutions. However, the participation of scientists in science communication activities generally remains abysmal. In such situations, it is crucial to understand Indian scientists' willingness to engage and their perceptions, attitudes, barriers, impediments, and incentives that determine how and how frequently they would engage in such activities. As there is a lack of empirical understanding on this critical topic in the Indian context, therefore, the main aim of the current research is:

### **Aim**

To investigate how senior Indian scientists engage in science communication activities and how their engagement can be improved by exploring their perceptions and attitudes toward different aspects of science communication.

### **Objectives**

To fulfil the above-mentioned aim, the current study has the following research objectives:

1. To explore what Indian scientists think about a) the importance of science communication, in general, and b) their roles and responsibilities for science communication, in particular.

2. To understand a) how Indian scientists engage with the general public and the media, and b) its impact on their career advancement.
3. To identify the factors affecting their active engagement in science communication with the general public and the media.
4. To determine the needed interventions for enhancing science communication by Indian scientists in the near future.

This exploration would provide insights into further improving science communication by scientists in India and inform policymakers how to get scientists to engage more with the public.

### **1.7. Overview of research methodology**

This research uses a nation-wide cross-sectional online survey method for collecting empirical data from Indian scientists and academic researchers who are: 1) elected Fellows of any of the three national science academies of India – Indian Academy of Sciences (IASc), Bengaluru; Indian National Science Academy (INSA), New Delhi and National Academy of Sciences, India (NASI), Prayagraj (erstwhile Allahabad), and 2) Currently living in India. It is worth mentioning here that these academies select academicians, scientists, or researchers as their Fellows only after they have achieved a certain level of excellence in their area of expertise and experience. Therefore, these Fellows are generally top-rated, experienced, and celebrated experts and senior members of their respective fields of expertise.

The Fellows of the three academies were invited through email to voluntarily participate in the study by anonymously filling an online questionnaire. The questionnaire consisted of 47

open and closed questions (12 demographic questions and 35 questions based on research objectives). The questionnaire explored the views and perceptions of Indian scientists on the various aspects of science communication. For grading and ranking the perceptions and attitudes, Likert scales were used. Efforts were made to maximise responses by sending follow-up emails. The survey conducted during October 2018 succeeded in collecting 306 anonymous responses, out of which 259 complete and valid responses were used for this study. These respondents came from nine different academic disciplines. They were affiliated with different organisations/institutions, including universities, R&D institutes, NGOs, private companies and corporates. The sample of these Fellows consisted of very senior (86% aged > 55 years), experienced (81% having > 30 years' experience), and scientifically very productive (61% having >100 research publications) scientists. More than 50% of them occupied top scientific and administrative positions in their organisations, such as department heads, group leaders, institution heads/directors, vice-chancellors, and even the secretaries of science ministries. In the scientific establishment, people holding these key positions generally have a say or control over policies related to science and its communication. Therefore, this online survey, while giving a voice to Indian scientists' views, attitudes, current practices, and experiences about science communication with the general public, provides valuable insights for devising appropriate training and policy interventions to advance science communication in the country. Detailed information on research methods covering survey design and execution is provided in Chapter 3 on Research Methodology.

### **1.8. Significance and scope of the study**

The current study, the first of its kind in India, provides empirical evidence on what senior scientists in India think about science communication and its importance, their roles and responsibilities, their current practices of engagement in science communication activities,



the impact of engagement on their career advancement, factors affecting their active engagement in science communication and the further possible interventions for enhancing scientists' involvement in science communication. The study provides nationwide cross-sectional empirical data that discusses and describes senior Indian scientists/academic researchers' views, perceptions, behaviours, and activities about the public communication of science. While providing empirical evidence in the form of some baseline data, the study adds to understanding science communication in India from the scientists' perspective.

Therefore, the present research tries to fill an important gap in the literature on science communication in India by providing a holistic view about science communication from the Indian scientists' point of view. The focus of this study is to generate some baseline data on how senior Indian scientists engage in science communication and the ways for further enhancing their engagement. The study would be useful in devising appropriate capacity-building or training interventions for scientists. It would also provide valuable inputs for future policies on science communication and science-society interactions in India. The current study would guide in deciding the role of scientists in science communication and how scientists' public engagement is related to their careers. It would also provide some empirical baseline data and suggestions for further research.

The current study's findings would contribute to advancing science communication as an area of academic and professional expertise, popularising the culture of science and scientific temper, and reducing the gap between science and the public. Such contributions can help transform society into a scientifically aware citizenry and contribute to our national aspirations of becoming a knowledge economy and a global leader in science and technology.

## **1.9. Thesis Structure**

**Chapter 1 Introduction:** This chapter briefly discusses science communication as a field of expertise, calls for scientists to actively engage in science communication, constitutional and policy provisions in India for promoting science and scientific temper among the masses, background for the study, research objectives, significance and scope of the study, research methodology, and thesis structure. It presents an overview of the current study covering its conception and execution.

**Chapter 2 Literature Review:** It reviews the existing literature on the various aspects of science communication globally and in India. While providing an overview of the evolution of science communication as an area of scientific expertise and its historical aspects (especially the advances during the last about 30 years), different models and approaches developed and suggested for effective science communication, recent advances in the field, perspectives of different stakeholders including scientists. It discusses the evolution of different paradigms in science communication from deficit to dialogue to engagement to participation. When there are increasing demands for scientists to engage, scientists have their limitations and motivations. Therefore, this review covers the literature documenting various aspects of science communication by scientists, their motivations, views, perceptions, attitudes, behaviours, current practices, expectations, and limitations. Gaps in the literature are identified for establishing a context and proposal for executing the present study.

**Chapter 3 Research Methodology:** Here, the methodological design of the national online survey and questionnaire and its execution for collecting empirical data to address the research objectives are discussed. Selection of the survey population/sample, data collection

procedures, research techniques used, and justification and limitations of using online survey method for the current study are also discussed.

**Chapter 4 Results and Data Analysis:** This chapter presents and analyses the survey results for addressing the four research objectives of the study. It analyses the results from the demographic perspective and with reference to the research objectives to understand what Indian scientists think about science communication and their engagement.

**Chapter 5 Discussion and Interpretations:** The Indian scientists' views, perceptions, attitudes, and current practices around science communication are discussed based on the empirical data collected from the survey as presented and analysed in Chapter 4. The current findings are discussed and interpreted in the Indian context based on the extant literature on science communication. The findings are also compared with similar findings from international studies.

**Chapter 6 Conclusions and Recommendations:** This chapter summarises the study's key findings and discusses the possible implications of the current findings on the future of science communication by scientists in India, its use in devising policy and training interventions for enhancing science communication efforts in India. It also discusses the study's limitations and provides recommendations for improving connections between science and society and further research in the area.