Social media and communication by scientists: M. S. Swaminathan on Twitter

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Scientists use popular media to share views or facilitate greater understanding of their work. Social media also offers scientists the opportunity to build public opinion. Hailed as one of three most influential Indians of the 20th century by Time Magazine[1], renowned agriculture scientist M. S. Swaminathan has written prolifically in scientific and mainstream media. From March 2015, for a period of one year, his use of social media platform Twitter is being taken up as a case study of social media communication by scientists. This article analyses themes articulated by a scientist on social media and finds that this provides an entry for discussions on science and development. Through this study, it is suggested that scientists, especially in India, can intervene more actively, for greater authenticity, accuracy and understanding among social media users on scientific subjects.

Keywords: Agriculture, policy, scientists, science communication, social media, Twitter.

THE social media platform – Twitter, patronized by the influential and general population is known for brevity and immediacy as its characteristics. According to 2017 data, Twitter has over 310 million monthly active users worldwide. Twitter has varied users communicating simultaneously in real-time, forming social streams of connected data, providing value both individually and in aggregate[2]. It helps understand diverse perspectives at a given time and provides opportunity to communicate directly with opinion leaders. With the sheer volume of information it shares, Twitter is a communications tool unparalleled in connecting people to share information instantaneously[3]. Wu *et al.*[4] speak of how the top ten most-followed users on Twitter are individuals, not corporations or media organizations, indicating that space is available for scientists as well. There is a surge in two-way communication in social media, at a personal level and on issues of public interest. A 2009 study found an increase in positive perception towards social media and public relations with more two-way communication opening up direct channels between organizations and the public[5].

Microblogging websites become valuable sources for people's opinions and sentiments, providing data for marketing or social studies[6]. However, the authenticity of information here is sometimes questioned. It is therefore important for scientists to share scientific information and prevent misinformation. Eperen and Marincola[7] emphasize that scientists need to communicate on social media as successful communication happens when they employ the channels that the general public is currently engaged in. They concede that scientists may not find this space easy to use, as they see unprofessional platforms threatening years of life-changing research. Yet, mis-information is increasingly a matter of concern. Research is often not accessible to public. Findings may be misunderstood, when scientists do not engage with public on research issues. Therefore, it is necessary as Pearce[8] suggests to scholars, to insert discussions in social media by themselves and instead of complaining, work with journalists, governments, and pundits to understand challenges of use of social media.

Parsons[9] points out that one benefit of Twitter is the ability to allow journalists using Twitter to track cutting-edge and reportable scientific research. Reaching politicians and decision makers is another benefit. However, Bode and Darlymple[10] suggest that Twitter is driven by being an alternative media outlet, rather than being an appealing platform in its own right. Ehrenberg[11] is also concerned about misinformation on social media and how it travels faster than the truth. A study among marine scientists on Twitter[12] found that a scientist's following on Twitter was substantially larger in number than the same scientist's academic circle, contending that it speeds up connections between scientists in the virtual space.

In agriculture, Allen and Abrams[13] found that information by agriculturalists on Twitter helps others have a better understanding, dispel myths and combat negative information in an agricultural crisis, showing opportunity for the scientific fraternity.

M. S. Swaminathan, considered as one of the most influential Asian scientists of the 20th century[14], is known

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for his contribution to food security. *The Wall Street Journal* named him as a Nobel Peace Prize contender in 2014. *The Time Magazine*[15] lists him among three most influential Asians of the 20th century, others being Mahatma Gandhi and Rabindranath Tagore. Swaminathan ventured into Twitter regularly from March 2015 with the user name @msswaminathan, which is being taken up for the case study.

Objectives

This study analyses the relevance of social media for sharing information on science and scientific ideas. Using the case study of scientist M. S. Swaminathan's presence on Twitter, it examines how social media users receive science and agriculture related content and considers greater possibilities of sharing in this space.

The following questions are being considered:

- What are the main themes of Swaminathan's Twitter messages?
- What is the impact of this communication in reaching ideas on science, agriculture and development to media and society?

While many corporations monitor social media to influence opinions[16], this study discusses the space for scientists on social media.

Methodology

Quantitative and qualitative analysis of Swaminathan's Twitter messages over a one-year period was carried out, studying their direct or indirect effect to understand the link between science and society.

Swaminathan issued 923 tweets from 11 March 2015 to 10 March 2016. The tweets formed part of 157 longer statements with the context, problem and solution to an issue. Since Twitter has a restriction of 140 characters per post, providing short tweets from longer statements is recommended for scientists[12] to overcome the difficulty of capturing a thought in one tweet. This is what Swaminathan has done – sharing each statement as several 'tweets'.

Thematic study of these tweets is carried out using framing analysis[17] which is described as selection of some aspects to make them more salient in a communicating text 'to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation for the item described' (p. 52). Each tweet was analysed for the predominant thought or motive with which it was issued.

The visibility on Twitter in mainstream media, is also considered for an understanding of the impact of Swaminathan's Twitter activity on policy and society.

Key Twitter terms

The context of certain social media terms is given here.

- 'Followers' refers to people who follow another Twitter user's activity regularly.
- The readership for a particular statement depends on how many times it is seen or shared on Twitter by other users.
- When a message is 'retweeted', it is repeated by another social media user and gains greater visibility.
- The 'hashtag' (#) is a symbol used with a keyword, such as #science or #WorldFoodDay that tracks a 'conversation' on a particular theme, event or subject. 'Hashtags' help follow real-time feeds of all related messages[18].
- Some tweets also link to external sites or share photos and videos.
- 'Mentions' link other users to the post to get attention of people.
- An 'impression' is the number of times a post is viewed by Twitter users.

Discussion and results

Between March 2015 and March 2016, Swaminathan's monthly average Twitter readership was 217,000 impressions. He had 8000 followers in March 2016, which grew to 13,800 in March 2017. This is significant in India as the Department of Science and Technology, Government of India, for instance, had about 10,000 followers in March 2017. In a search for the top 50 scientists on Twitter, whose profiles mention their profession, only six are Indian and Swaminathan has the largest Twitter following among them.

Swaminathan's followers include a range of people and institutions discerned by the given identity on Twitter. However, only a 'Twitter verified' account, indicates genuine identity of public figures or organizations. Subsequent to the study period, Swaminathan's account was also 'verified'.

Themes of the Twitter messages

Swaminathan's tweets address contemporary concerns while indicating solutions where possible. Some tweets used 'hashtags' or 'mentions', link to the full statement or shared photographs.

The posts on Twitter were marked by regularity, at least twice or thrice a week all through the year. Regularity helps increase and retain followers, thereby gaining more readership or 'impressions' on Twitter.

The 923 tweets issued by Swaminathan in this period were categorized as follows:

1. Agriculture and nutrition – suggestions, information or techniques on agriculture, food and nutrition security.

2. Policy and governance – relate to a government policy or scheme for inputs, changes.
3. Climate/weather – on climate change, weather, monsoon, heat or related incidents.
4. Natural resources – on environment, natural resources, conservation.
5. Science and innovation – on scientists, scientific activity, biotechnology, innovation.
6. Development – relate to millennium development goals (MDGs), sustainable development goals (SDGs), gender, urban and rural development, education, health and democracy.
7. Others – varied subjects from greetings on occasions, on celebrities and sport.

Whatever its specific use, framing consistently offers a way to describe the power of communicating text[19]. In cases where Swaminathan's statements contain interlinking themes, e.g. agriculture and climate change, or policy and nutrition security, the dominant theme has been chosen as the main 'frame', studying the keywords used, analysing the motive of the statement and relevance at that time. Figure 1 indicates the major themes of the Twitter messages by Swaminathan.

• The subject most focused on was 'agriculture and nutrition', with 30% (280) of the tweets focusing on suggestions on agricultural techniques, strategies for food security and developments in nutrition. Given that Swaminathan is an agriculture scientist, this seems logical.
• The next highest category of tweets was on 'Policy' with 20% of the messages focusing on suggestions for national and global agenda as well as suggestions and recommendations for existing or new schemes.
• Over 15% of messages focused on development. References were made to global goals – MDGs and SDGs, on rural and urban concerns, democracy and equity.
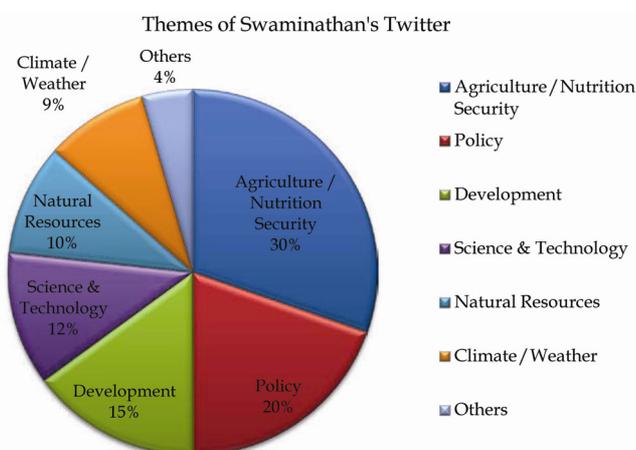

Figure 1. Predominant themes of Swaminathan's statements issued for Twitter.

• About 12% (109 posts) focused on science, technology or innovation. They include science and technology, research, insights on national or global scientific events.
• Tweets on conservation and environment formed 10% of all posts, including messages on water, soil and other natural resources. Agriculture was also referred to, but the motive was resource conservation, in general.
• Climate and related issues formed over 9% of the messages. Weather, monsoon and extreme event related statements have been included here. Emphasis on climate change adaptation was a major concern in these statements. As the Conference of Parties – the 2015 Paris Agreement on Climate Change was during this period – his concerns were linked to related global and national discourse.
• The messages under 'Others', i.e. 4% of the statements include posts directed at specific persons, greetings on festive occasions, personal reminiscences or acknowledgement to other Twitter users.

While the two categories of agriculture and science are separately provided, there are scientific interventions in both.

Over 96% of the messages fall into one or the other of six major themes that Swaminathan's work as a scientist and institution founder focuses on. The growing follower base and consistent readership make it evident that there is interest in this information on social media.

Swaminathan's Twitter had a total readership of over 2.6 million during the year, showing that agriculture and development are of interest to social media users.

Darling et al.[12] suggest that scientific conversations on social media are available to a wider audience, beyond scientific circles and form public opinion on that subject. Swaminathan's Twitter engagement on agriculture, science and development shows that an Indian scientist can effectively link authentic science to social media.

Impact of Swaminathan's Twitter account activity on media, policy or society

A closer analysis of the activity around the tweets helps understanding as to which are more impactful and the possible reasons for that.

Research carried out during ED-MEDIA conference in 2009 shows that the scientific community started to use Twitter as an important tool for communicating and exchanging thoughts, resources and continuative links[19].

The tweets with greater impact

To understand the impact, the most popular tweets in terms of 'impressions' were taken (Table 1). The content,

Table 1. Analysis of popularity and impact of Swaminathan's top tweets 2015–16

Tweet	Timeliness	Persona/science	Media intervention	Policy
Farmers in Vidarbha unable to sell bullocks ...	Beef ban in Maharashtra was being widely discussed in media and public domain with strong views on all sides, many of them political. Therefore timely.	An apolitical intervention in this discussion brought a different dimension and Swaminathan's suggestions were read widely, given his stature as an agriculture scientist.	This was shared widely by many media persons. A senior journalist additionally interviewed him and shared his views on this subject.	Swaminathan's tweet created awareness about 'Gokul Gram Yojana' scheme for indigenous cattle that had not taken off. This statement brought focus to a policy that had not got adequate attention.
With IMD forecasting a 35% probability of deficient #monsoon..	Timeliness is important for this tweet, since deficient monsoon forecast was dominating the front pages of news on that day.	Moving ahead from the forecast, Swaminathan's tweets on dealing with the situation were useful as he provided suggestions and possible solutions to deal with the scenario. This was beyond what any other social media user could do.	A popular TV news network called attention to Swaminathan's comments on social media. They also interviewed him mentioning his social media account. This increased visibility for his comments on and outside Twitter.	This drew attention to possible solutions and intervention by the government. In both cases, activity beyond social media through mainstream media added to visibility and discussion on government action.
Need for 'Beyond the Earthquake Rehabilitation Movement' ... and The Habitation cum Rehabilitation Program designed for Kutch 2001... #NepalQuake	The Nepal Earthquake that brought large scale devastation was the focus of public attention at the time.	Providing practical and tested suggestions for moving ahead to rebuild were very relevant since there was need for experienced inputs for rebuilding the nation.	The media focusing on the disaster, picked up the positive suggestions of Swaminathan and referred to his 'tweets' on this subject, sharing news based on this.	High visibility for suggestions to rebuild Nepal helped policy makers and development workers discuss these with people who contacted him for further details on this.
On the whole #Budget 2016 has tried to be as pro-farmer as possible....	This message summarized comments on the Union Budget. It was issued on the same day it was presented in Parliament and therefore very timely.	Swaminathan's comments came at a time when many provisions for agriculture had been introduced in the Budget. His perspective as an agriculture scientist was important.	The statement was covered by major media reporting on the Budget and sharing reactions from different experts.	The statement attracted policy makers at the highest level, with India's Prime Minister quoting from this statement on more than one occasion.

context, media pickup and resonance with people in the society were considered. The top 10 tweets were:

1. Farmers in Vidarbha unable to sell bullocks due to beef ban and Gokul Gram Yojana yet to materialize. This is adding to their crop loss agony. Impressions: 47,050.
2. With IMD forecasting a 35% probability of deficient #monsoon, it is time we get ready with a deficient monsoon management strategy. Impressions: 25,717.
3. Need for 'Beyond the Earthquake Rehabilitation Movement' in Nepal. Text of my suggestions on http://t.co/GoElkrykaC #NepalQuakeRelief. Impressions: 21,414.
4. The Habitation cum Rehabilitation Program designed for Kutch, 2001 provided homes in short term & agro-based income in long term #NepalQuake. Impressions: 21,171.
5. On the whole #Budget2016 has tried to be as pro-farmer as possible. Seeds have been sown for agricultural transformation and a new farming era. Impressions: 20,208.
6. Gandhiji asked me when I was 7, to give my gold bangles and chain for Dalit welfare instilling the idea of giving to the needy #GandhiJayanti. Impressions: 19,902.
7. Many pulse crops had their origin in India and it is sad that we imported 10 million tonnes of pulses this year to balance demand and supply. Impressions: 19,607.
8. #Nairobi has paved the way for famines of the future. My concerns for #farmers and #foodsecurity of India; https://t.co/yMhSB2cLl6. Impressions: 19,270.
9. In the battle for eliminating #hunger, here's my 3-point strategy suggested for creating #ZeroHunger India; https://t.co/hAd9WzQHcP. Impressions: 18,261.
10. We need urgently a pan political commitment to safeguard education of children and livelihood security of widows in agrarian suicide hot-spots. Impressions: 18,246.

The top tweets were analysed for what possibly contributed to greater visibility: analysis of top tweets in Table 1.

The 'Beef Ban' statement was most 'engaging' to which readers replied or commented on the most. Since the issue was political at the time, Swaminathan's statement linking to agriculture distress brought a different dimension to the discourse. Greater visibility also included critical comments from social media users and from those with different views.

The 2016 Union Budget statement was the second most popular in engagement. It was also quoted by the Prime Minister of the country.

Eight of the top 10 tweets used hashtags (#), a word or phrase that was 'trending' or topical at that time. These

include #NepalQuake, #NepalQuakeRelief, #Gandhi-Jayanti, #Budget2016 and #Nairobi, all of which were among top discussions on Twitter on that day. Since Twitter focuses on 'What is happening now' anything currently happening is more visible.

Therefore, an intervention or research can be more visible or useful on social media if it is mentioned when a topical subject is being actively discussed.

#ZeroHunger the 9th most popular tweet, is also one of the Sustainable Development Goals. The concept of farming system for nutrition that he tweeted about added the nutrition dimension to agriculture. All top 10 tweets were picked up by mainstream media as articles and news stories. They were also shared on Twitter by journalists, attracting more attention.

The two tweets in the top 10, which do not use a hashtag are on agrarian distress and on pulses, both of which were being widely discussed at the time.

To summarize, social media visibility increases through mainstream media and attracts policy makers' attention to Twitter posts. Therefore, while scientific research forms the basis for credibility on social media, Twitter catalyses, adding visibility for inputs on topical issues.

The tweets with less impact

The 20 tweets with the least impressions during the year and possible reasons were examined.

- Ten out of the least impressionable tweets are replies to other Twitter users or acknowledgements. Social media provides opportunity to engage with people and it is good practice to respond. However, this may have limited interest for other users.
- 18 of the 20 least popular tweets do not use a hashtag. In general, hashtags expect to increase visibility.
- None of the 20 relates to the 'policy' frame. Social media users seem to relate to more policy inputs from a scientist as indicated by the most popular messages.
- The tweets with limited engagement contain a short text or a partial thought, with more information in a preceding or following tweet.

Conclusion and way ahead

From the case study of Swaminathan's the Twitter account indicating growth and readership, it is evident that there is space on social media for scientists to intervene with their expertise. While it may not be feasible for a scientist to engage daily in public domain, social media provides opportunity and new avenues for regularly reaching new audiences.

Unlike other science content on social media, Swaminathan's Twitter does not link to his publications, and

focuses on contemporary issues from experience through studies and work. Sharing research is one aspect, engaging in dialogue on science with greater understanding of related issues is another.

Except occasionally, almost all of Swaminathan's posts, relate to solutions on important issues. It is different from most social media use, as he probes, identifies and attempts to resolve important development concerns at a given time.

Swaminathan's social media activity as a case study, indicates significant scope for discussion or visibility for science, agriculture, food security, climate change and development on social media, with regular engagement. The surge in social media communication in India has also given opinion leaders impetus to engage with policy makers, journalists and public.

For the future, it may be appropriate to study social media user attitudes on science and development. Detailed studies in the Indian context about Indian scientists and social media are limited. Greater understanding of what is changing in science communication and social media in India and its impact can provide insights into scientists' intervention in this space. It can provide an opportunity to bring verified and authentic scientific information in a more impactful way to intervene in the fast growing social media space.

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