Science Communication and Role of Media in Nepal

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ABSTRACT

The importance of communicating scientific knowledge was realized very early in the developed countries. Today most universities and educational institutions have devised science and journalism courses and use innovative approaches to increase the understanding and application of science knowledge for access to a general audience. The exponential growth of information technology and growing interests >90% seeking science related information in social, news and print media has helped science communication flourish in developed countries. On the other hand, in the developing countries science communication is still not a priority. Of various S&T institutions, National Academy of Science and Technology (NAST) stands out for taking major initiative. The advancement of communication technology and changing dynamics of social media due to internet, facebook and google access has helped Nepal to raise social awareness but providing evidenced based information remains a low priority. The chapter attempts to review the history of science education and communication in Nepal and the role of Nepalese media and global media trends. The information presented is based on published and unpublished literature and feedback from S&T institutions and schools, policymakers, school teachers, students, parents and community leaders. A list of Key performance indicators (KPIs) such as funding source, teachers' availability, students' enrolments, resource availability and development trends of the science education and community science awareness program in regional and remote areas are discussed.

Keyword: Science, Communication, Science education, Media, Information

1. Introduction-Science Communication

Science communication is the practice of informing, educating, raising awareness of evidenced based information for greater benefit of the people and planet. Science communication is classed in two different types i) outreach (Scientists to non-expert audiences) and ii) in reach (communication with scientific backgrounds) (Fig. 1).

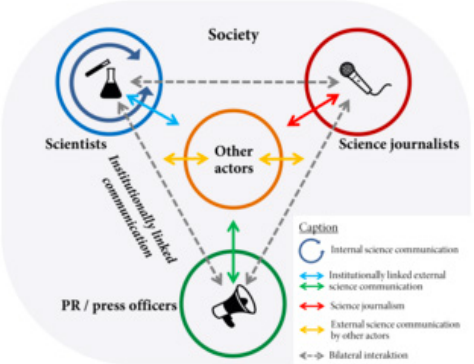

Fig. 1 : Schematic overview of the field and the actors of science communication according to Carsten Könneker (https://en.wikipedia.org/wiki/Science_communication)

Science communication has a long and deep-rooted history and was driven by scientific discovery before it has reached this stage of digital communication age). Science communication is essentially described in three stages of development. The first generation of science communication centred on filling in the gaps in the knowledge of the general public. The second-generation approach favoured a more two-way dialogue, and the third-generation approach aims to continue two-way dialogue, but also transfers greater ownership to the general public.

In ancient Greece, imparting knowledge was shared in public debate by the masses. Such debates triggered logical analysis and experimentation which later helped in the advancement of philosophy and science. Later scientific discoveries from knowledge generated from such debates were translated in writing but unfortunately the masses were unable to process the knowledge described in writing. With the growing literacy and the invention of the printing press in 1456 eventually helped spread the knowledge to broader masses, increased literacy and the responsibility to communicate knowledge to the general public (Roberts-Artal 2015).

In the 19 centuries, British Science Association (BSA) first meeting held in York in September 1831, brought national attention to science discovery and communication and inspired the formation of several professional associations for the advancement of science globally, and created a forum for an annual meeting.

The late 20th century could be called a golden start of science communication "and" public engagement. Michael Faraday a famous scientist who discovered electricity, used to run lectures aimed at the non-expert public which began in 1825. The 20th century saw science positioned in a broader cultural context and allowed scientists to communicate their knowledge in a way that could reach and be understood by the general public. Science can be communicated to the public in many different ways. Traditional journalism is one way communication. The second category is live or face-to-face events through public lectures, debates, science busking "sci-art" exhibits, science cafés and science festivals, citizen science or crowd-sourced science, is a two-way science communication. The third category is online interaction; for example, websites, blogs, wikis and podcasts and other social media.

With the advent of citizen science, the general public are now in a position where they are not only choosing what they want to be informed about, but are taking an active role in the pursuit of this knowledge. Citizen Science is a phrase that is currently dominant in scientific communication circles. It is a forum of collaborative research with the general public (or citizens), which helps in collecting and generating data Human Genome Project, the world's largest collaborative biological project is a great example of science for and on behalf of the greater good (Roberts-Artal 2014).

Several countries have now adopted the policy to encourage research organizations to communicate about their research activities and results widely and to the general public. All research projects now have an obligation to integrate a communication plan to increase the public visibility of the project using an accessible language and adapted channels and materials. It is a globally accepted fact that the status of science communication and popularization of any country is one of the indicators of its economic prosperity.

2. Science Communication in Nepal

In Nepal, the political change in 1950 is being marked as the beginning of science and technology activities which led to establishment of a number of S&T related institutions and infrastructure, promotion and dissemination of scientific information. In Nepal, where only 20% of schools teach science courses, science education and communication are not a priority. Both public and private science institutions, as well as

professional societies, are doing little to advocate science education and communication largely due to budgetary constraints. Despite the national pledge for making science education as the basis for economic development and the promise to invest about 0.5% of national GDP in science and technology, lack of international funding, scientific vision, approach and leadership have severely hampered the science education and communication in Nepal.

Despite different governments reiterating their commitment to S&T and science education in the last seven decades, there has never been a long-term commitment to strengthen existing institutions, infrastructures and skilled human resources. Nepal Academy of Science and Technology (NAST) has prepared a discussion paper on Scientific Research, Technology, Development, Transfer and Dissemination-Some Guiding Concepts in 1983 but it has not been materialized to the significant extent till date. In the following section, a bird's eye view of history of science education, science policy, institutions related to science and technology, national and international players active to promote S&T in Nepal, role of media for the promotion of science, and global media trend is discussed and is limited to natural science and technology. The author believes that it is important to understand the history of science education and media roles in perspectives to understand the current status of science communication in Nepal.

3. Brief History of Science Education in Nepal

Prior to modern education in Nepal, Sanskrit education based on Hindu religion scripture Vedas, Upanishada, Jyotish (Astronomy) and science of rituals (KarmaKanda) was the main source of knowledge and path to spiritualism known as eastern Philosophy. The Hindu religious scriptures and Vedas manifestation on ritual practices later gave rise to the traditional science and technology such as Ayurveda, Vedic mathematics and agriculture, Astrology, etc. Modern science education was integrated with the above knowledge and was considered as an inevitable tool to achieve a higher standard of living and a convenient life free from physical labor. In Nepal, the modern-day school education began from the year 1854 with the establishment of the first school called Durbar High School and after the major political shift in 1951, the Government put significant efforts to vitalize the education system. National education planning commission, national education committee and the national education advisory board were formed to reform the education system.

At the higher education level, Trichandra College established in 1919 was the only college to teach science and science was allowed as an extra subject for the school leaving certificate (SLC) examination. Tribhuvan University (TU) chartered in 1959, was the only institution to grant undergraduate to PhD degrees. TU colleges offer a wide range of courses in different disciplines such as social sciences, humanities, education, commerce and business, law, sanskrit, and natural sciences including medical sciences, engineering, agriculture, and forestry. The political change in 1990 which led to establishment of a multiparty democratic system of governance brought further changes in the education system of Nepal. Subsequent political change in 2007 manifested education as one of the fundamental rights of the people. The Government introduced a new national education policy in 2019 which laid emphasis on technical education and scientific methods in the education system, adoption of Science, Technology, Engineering, and Mathematics (STEM) education in Nepal. Despite importance to science education, it continues to be taught in isolation from social context and fails to capitalize the significance of science knowledge and communication to empower people and negate superstitions and pseudoscience.

Nepal National Educational Planning Commission (NNEPC) in 1961, recommended science as a compulsory subject from grade six to eight and optional subject in grades nine and ten with emphasis on management of science laboratories and effective teaching of science. Science was made a compulsory subject in all three types of schools viz., general, sanskrit and vocational secondary schools and emphasized on the construction of laboratories and teaching materials at the local level. This provision made establishment of science laboratories compulsory in every secondary school.

Sixth Five-year plan of Nepal (1980-1985) linked science and technology with economic development of Nepal and aimed at developing and promoting the S&T sector as the engine to drive the social, economic, physical, and environmental development. Over the years, the education commission gave priority to science and one of the important milestones was the establishment of Science Education Project (SEP) in

1982, National Science Education Development Centre (SEDEC) and Science Education Development Units (SEDU) at 25 selected districts throughout the country. The National Council for Science and Technology initially established in 1960 for advisory policy making in S&T was later succeeded to the permanent function of Nepal Academy of Science and Technology (NAST, established in 1982 as the apex S&T body.

Nepal does not have a long history of written policy on S&T. The third and the latest policy on S&T was promulgated in 2019 by the Ministry of Education, Science and Technology as "National Science, Technology, and Innovation Policy, 2019". In Nepal, science policy is being revised in the interval of almost every 15 years but no national commitment was shown to implement the documents as such. Major objectives of the new policy are to ensure research-based quality education, use of innovative technology in the productive sectors, developing such environment for the scientific talents to carry out research, opportunity to exhibit inventions, ensuring enhancement of the entrepreneurship, restructuring of the existing research-based institutions, and creating conducive environment for scientific research and technology development by scaling up the investment and promoting collaboration and science communication. (Nepal Education since 1951; Bajracharya & Brouwer 2007; Gimeno 2019).

4. Role of Nepal Media and Science Communication

Even though the formal education of science began in Nepal with the Intermediate in Science (I.Sc.) program in Tri-Chandra College in 1919 and in School in 1939 as an extra subject, science subject quickly became popular as it created inquisitiveness in young minds and provided the opportunity for a professional career path. Science communication activities such as exhibitions, science fairs, and competitive quiz programs were conducted in a limited way by academic institutions. The history of science popularisation in real terms began through IDRC funded project by the Royal Nepal Academy of Science and Technology (RONAST) in 1984 (Huggan 1987). Earlier to this, Nepal media was not covering science features due to a lack of training and subject specialization in a contemporary science discipline. In the mainstream media, science simply did not find a dedicated space.

The above project was the first collaborative program on science communication with Nepalese media practitioners, publishers, and editors. The project focus was science popularization at the community level working with the press and radio of the country through local-language print, broadcast media, and with local newspapers. The Nepal Khabar was the to first publish science features-free of cost as a bi-monthly publication in the remote parts of the country and set a road map for other newspapers to publish science-related columns and articles. The Weekly Science and Technology Radio Program, aired on Radio Nepal, was another stepping success as 55-65% of the population had access to radio and benefited from the program. Nepal Radio Nepal's excellent network of relay stations provided a much-needed infrastructure.

The science program, delivered in a print format, covered general knowledge on science, the latest news from science labs around the world, interviews with various scientists, features on scientific institutions, and a radio quiz question-and-answer portion. More than 400 letters from 76 districts in Nepal were received by broadcasters working on the radio program and Radio Nepal science communication was hailed as the third most popular program. Mr. Gurung from the Centre of Education and Development Administration (CEDA) in his report on Science Popularization, highlighted the lack of funding and infrastructure to train science journalists as the most limiting factor The report recommendation led to the establishment of two specialized training workshops on science reporting and 40 science writers and broadcasters benefited from the workshops.

The strategies to work with editors and broadcasters on a continuing basis with coordinated efforts provided the much-needed foundation on the ground support. Radio Nepal and RONAST continued to work in the production of weekly science programs with stories of science and technology to everyday life through interviews. The establishment of science communication awards and prizes to encourage participation and ongoing review of the impact of the project's various components helped design a long-term science popularization program for Nepal. This strategy further helped 'establishment' of regular science columns or pages in the national newspapers, under science service produced by Rastriya Samachar Samiti (RSS Nepal's national news agency), and regular science and technology programs broadcast by Radio Nepal (IDRC report 1992).

However, scientific learning mostly remains limited

to books. Authorities in Nepal did little to promote science communication in the country to the next level. Many scientific organizations, government, and internationally funded projects established to promote science did little to expand the science communication network. Apart from organizing and hosting seminars, their engagement with the public at large remained limited. There are no dedicated shows on science or related material to trigger excitement in young kids and adults. Schools are running quiz shows and science exhibitions but are mostly urban-centric. The media still find space for sensationalizing any hysteria, hoaxes, or superstitions without thorough reporting which is counterproductive. The media support of efforts on the conservation of biodiversity in Nepal as grassroot campaigns was however hailed as a success to promote science communication and gained some traction. (https://blogs.scientificamerican.com/scicurious-brain/scicurious-guest-writer-societal-challenges-to-science-communication-in-nepal/

Lately, community radios in Nepal have used digital online portals and started podcasting science communication to reach out to marginalized listeners and extend their reach to those that prefer to receive their audio content from online platforms. Since April 2020, they started COVID-related information from verified sources and are now able to connect and share information with the world and unite the members living in different countries. The presence of community media on the internet will help minimize disinformation and fake news and build trust to take the information seriously.(Radio Madanpokhara podcast: http://bit.ly/3nLUcda, Radio Langtang podcast link http://bit.ly/3rm7tLx, Radio Kapilvaste podcast link http://bit.ly/3azlWy3, https://onlineradionepal.gov.np/en/2023/02/21/347304.html, https://www.unesco.org/en/articles/reaching-out-unreached-community-radios-nepal-take-podcasting

Nepal media initiative like Nepal Radio Education Teacher Training Project (RETT) for upgrading underqualified primary school teachers using radio techniques such as intensive broadcasting and, interactive learning with the help of USAID is helping teacher training and science communication, https://pubmed.ncbi.nlm.nih.gov/12315027/

Nepal celebrates National Science Day on Ashoj 1 (September 17) amidst various programs to highlight the progress the country made in science, technology, and innovation and help create a favorable atmosphere for the youths to study science and utilize their knowledge and skills. The government has initiated the science diplomacy dialogue and Science Journalism prize and expects that such an initiative will help raise public awareness of science and technology and science communication initiatives (Rastriya Samachar Samiti 2021 Kathmandu).

Both public and private media channels have grown exponentially in recent decades and is a growing industry. But in all of the media channels, science communication is a least priority especially in private media channels Radio, TV and internet and is dependent on sponsors.

Nepal Academy of Science and Technology (NAST) Science Popularisation Program

Following IDRC project, NAST has commenced following science communication and popularisation program (https://nast.gov.np)

1. Radio Program: First ever radio program on Science and Technology
2. Television Program: First ever television program dedicated to Science and Technology Publication
3. Vigyan Lekhmala: a popular science magazine in Nepali Language on contemporary issues in different fields of science and technology, distributed to school library media outlets to disseminate the information on science and technology to the general people.
4. NAST Communicator: A periodic bulletin in English language that covers the major NAST events
5. Popular Science Book Series: publishes queries raised by Science students and experts' response to the queries and aims to establish the culture of scientific curiosity in the society.
6. Booklets: On different scientific topics to make general people aware of the issues and very easy to understand for the common people.
7. Internal Circulation (NAST Sanchar): A weekly bulletin of internal activities of NAST

8. Nepal Journal of Science and Technology: A peer review journal to provide a forum for Nepali Scientists and Technologists to publish their original research articles carried out in Nepal.
9. Proceedings of Conferences, Symposium, Seminars, and Workshops: A publication of proceedings papers presented in national and regional conferences, seminars and workshops organized by NAST.
10. Other Scientific Publications: Has published more than 150 major study reports, manuals, proceedings, research reports, occasional papers, popular science series, science feature for media, books etc.
11. Awards , Felicitations, and Fellowships:

Following are the list of annual awards given away by NAST.

a. The Chancellor Innovation Award: For making outstanding contribution in the field of Innovation in Nepal.

b. Science and Technology Academy Award: Conferred every two years for making remarkable contributions in the field of science and technology.

c. Nature Conservation Award: for outstanding contribution in nature conservation under any genre of science and technology.

d. Science Award: For extensive contribution in the field of science. It is conferred annually to scientists who have crossed 40 years of age.

e. Technology Award: For extensive contribution in the field of technology. It is conferred annually to the technologists who have crossed 40 years of age.

f. Youth Science and Technology Award: awarded to five young scientists below forty years of age, for endeavour and dedication in their field of expertise.

g. S&T Promotion Award: Awarded to two persons for promotion of S&T, and for creating public awareness on the importance of science and technology.

h. The World Academy of Sciences (TWAS) Award: for making remarkable contributions in Biology, Chemistry, Mathematics, and Physics.

i. NAST-Nabil Award: For making tangible contribution in the selected disciplines of Science and Technology

j. MD Basnyat Technology Academy Award: Awarded to an individual or institution for paramount contribution in research, especially in the field of energy.

k. JB Nakarmi Metalwork Award: for contribution on the metal related technology.

l. Bhubaneswor Low-Cost Technology Award: awarded to an individual or institution for the contribution on the low-cost technology.

m. Dayananda Bajracharaya Research Award: Awarded to best M.Sc. in Botany, Biodiversity, Biotechnology, Environment, Microbiology and Zoology.

n. Fanindra Prasad Neupane Research Award: for M.Sc. Thesis related to Plant Sciences.

o. Science Journalism Award: This Award is given annually to a journalist who makes outstanding contribution in propagating scientific news through different media.

p. Woman Scientist Awards: awarded to individual female scientists for her extensive contribution in the field of science.

q. Science Teacher Award: Awarded to science teacher for science teaching in schools.

r. Science Students Award: Awarded to best two students for securing the best result in science stream in the grades 11 and 12.

Apart from the above awards, NAST also established awards for outstanding personalities who contributed in laying the foundation of Science and Technology in Nepal. NAST also supports Nepali Scientists, Technologists or Innovators providing following different Grants and Fellowship schemes.

Research and Travel Grants: Awarded to researchers and innovators for research activities or innovations and to attend the scientific events. NAST also provides M.Sc. Thesis grant for promising proposals in different disciplines of Science and Technology.

Fellowship: One-year fellowship such as Brain-pooling Nepal fellowship, Research Fellowship, Assistant Research Fellowship and Research Assistantship outstanding Ph.D. candidate fellowship.

NAST honorary fellowship: NAST Eminent Fellow, NAST Associate Fellow, and National Researcher Identity is awarded to the prominent Nepali Scientists or Technologists working in Nepal or abroad for their outstanding achievements.

Science Communication Campaign: Since its inception the academy has been actively involved in promoting public understanding in science and technology through various science popularization programs. The NAST is so far the only institution in Nepal that has been conducting regular programs to popularize science and technology among the people. In 1985, the academy launched a Science Popularization Project with grant support from the International Development Research Centre (IDRC), Canada. The objective of the project was to enhance science literacy among general people by utilizing mass media channels. This was the first systematic attempt to make the attributes of science and technology accessible to the general public in Nepal. Science popularization programs are now fully operated by the academy with its own resources. These programs include organization of science exhibitions, interaction and lecture programs, publication of science magazines and journals.

Science Fair: Science fairs are organised in different parts of the country, mostly in collaboration of local schools. The objectives of these programs are the increase public awareness on the importance and usefulness of science and technology in people's daily life and cultivate a scientific temperament among young people. The programs include a wide range of participatory activities for the high school students such as Competitive Science and Technology Exhibitions (High Schools Level), Science and Technology Quiz, Oratorical Contest, Essay Competitions, Science Teachers' Workshops/Training, Lecture Programs, Public interactions, Environment Camp (Occasionally), Science and Technology Film show. For greater participation of school children and the general public, these activities are tied up with local cultural and sports events.

Scientific Events: Periodic scientific events such as Science Fair, Trainings, Workshops, Seminars, Talk programs, Science Dialogues, national and regional science conferences, international events in Kathmandu as well as in different parts of the country are organised regularly.

Scientists' Forum: NAST has formed Women Scientists' Forum and Young Scientists' Forum to emphasize the roles of women and youth in Science and Technology for future.

Nomination to participate in international flora: To potential candidates of NAST or other institutions of the country to participate in different activities conducted by the institutions, societies, or academies related to Science and Technology in different parts of the world.

When the government of Nepal designated a separate ministry to take care of Science and Technology of the country in 1996, the Ministry also conducted similar activities. The B.P. Koirala Planetarium, Observatory, and Science Museum is an institution under MoEST that conducts science popularization activities such as producing television programs, publication of journal, organize training and other events related to science popularization, show scientific movies in it 3-D theatre, open science museum and observatories to all interested ones, etc. Different institutions under the universities of Nepal and other non-governmental institutions are also aggressively involved in science popularization missions in Nepal. The list of successful institutions involved in formulating the foundation of science and its popularization through different types of services in Nepal are summarized in Table 1.

Table 1: Following is the list of institutions involved in formulating foundation of science and its popularization through different types of services in Nepal.

SN	Estd. Year (AD)	Name of the Institution
1	1890	Prithvi Bir Hospital
2	1894	Bell Tower
3	1901	Gorkhapatra Press
4	1911	Pharping Hydroelectric Power Plant (Chandrajyoti Hydro-electric power station)
5	1911	Bijuli Adda/Dept. of Electricity (1962)
6	1913	Telephone Line Distribution, Trunk Call (Ktm to Raxaul)in 1914,
7	1916	Automobile

8	1918	Trichandra College
9	1922	Ropeway (22 km), Extended to 42 km (1964)
10	1924	Agriculture Office
11	1927	Railway Service
12	1932	Technical School
13	1934	Civil Medical School (Paramedics)
14	1936	Biratnagar Jute Mills
15	1937	The Juddha Fire Brigade
16	1939	Department of Livestock Services
17	1942	Training School for Sub-Overseers
18	1942	Forest Training Center for Rangers
19	1947	Nepal Forestry Institute
20	1948	Department of Publicity, Department of Information and Broadcasting
21	1950	First Aeroplane Landing
22	1951	Radio Nepal
23	1954	Engineering School
24	1955	Department of Forest
25	1956	Department of Soil Sciences
26	1957	School of Agriculture, College of Agriculture (1968)
27	1957	Survey Department
28	1958	Department of Geology and Mines (DHM)
29	1958	Department of Survey
30	1958	Central Bureau of Statistics (CBS)
31	1959	Tribhuvan University (TU)
32	1960	Department of Medicinal Plants
33	1960	Botanical Survey & National Herbarium
34	1960	Balaju Yantra Shala
35	1961	Department of Food (1961), Food Research Lab (1966)
36	1962	Department of Hydrology and Meteorology (DHM)
37	1963	HMG's Press, Dept. of Printing and Publication (1988), Dept. of Printing (1992)
38	1963	Butwal Technical Institute
39	1963	Forest Survey Research Office
40	1964	Royal Drug Research Laboratory (1964)
41	1965	Janakpur Cigarette Factory (Estblished with Russian Support) Closed in 2011
42	1965	Postgraduate Departments of Natural Sciences, TU
43	1968	Lumle Agriculture Research Centre
44	1968	College of Agriculture
45	1970	Department of Roads
46	1970	Department of Buildings
47	1971	Ministry of Communication
48	1971	First Computer in Nepal (2nd Generation IBM-1401) for National Census
49	1972	Royal Drugs Limited

50	1972	Institute of Medicine, TU
51	1972	Institute of Agriculture and Animal Sciences, TU
52	1972	Institute of Forestry, TU
53	1972	Institute of Engineering, TU
54	1973	Department of National Parks and Wildlife
55	1974	Himal Cement Factory (First Cement Factory in Nepal), Closed in 2002
56	1974	Department of Soil Conservation & Watershed Management
57	1974	Electronic Data Processing Centre (EDPC), National Computer Center (1980)
58	1975	Trolley Bus (Tripureshowor to Suryabinayak, 13 km), Ended in Nov 2008
59	1975	Nepal Telecommunication Corporation, Nepal Telecom (2004)
60	1975	Agricultural Project Research Center (APROSC)
61	1975	Natural History Museum
62	1976	National Council of Science and Technology (NCST)
63	1976	Nepal Institute of Standards (1976), Nepal Bureau of Standards (1981)
64	1977	Research Centre for Applied Sciences and Technology (RECAST) TU
65	1980	Department of Drug Administration (DDA)
66	1980	Department of Agriculture Development
67	1981	Water and Energy Commission
68	1981	Herbs Products and Processing Company Limited
69	1982	Nepal Academy of Science and Technology (NAST, 2007)
70	1982	National Trust for Nature Conservation (NTNC)
71	1982	Department of Ayurveda
72	1983	International Centre for Integrated Mountain Development (ICIMOD)
73	1983	Nepal Forum of Environment Journalists (NEFEJ)
74	1985	Nepal Television
75	1985	National Forensic Laboratory
76	1985	Bhrikuti Paper Mills, Privatized with Golchha Org. (1992), Closed in 2011
77	1986	Research Laboratory for Agriculture Biotechnology and Biochemistry (RLABB)
78	1986	Resources Himalaya Foundation (RHF)
79	1986	Mahendra Sanskrit University
80	1988	Department of Irrigation - Department of Water resources and Irrigation
81	1989	Centre for Rural Technology (CRT)
82	1989	Centre for Technical Education and Vocational Training (CTEVT)
83	1990	Centre for Environmental and Agricultural Policy Research
84	1991	The Pyramid Laboratory
85	1991	Kathmandu University (KU)
86	1991	Nepal Agricultural Research Council (NARC)
87	1991	Nepal Health Research Council (NHRC)
88	1991	Centre for Renewable Energy
89	1991	Department of Water Induced Disaster and Prevention
90	1992	B.P. Koirala Memorial Planetarium, Observatory and Science Museum
91	1992	Gorakhkali Rubber Industry (GRUL), Halted Production in 2014

92	1992	Environment Protection Council
93	1992	Nepal Environmental and Scientific Services (NESS)
94	1993	B.P. Koirala Institute of Health Sciences, upgraded to deemed university (1998)
95	1993	World Wildlife Fund (WWF), Nepal
96	1993	Department of Electricity Development
97	1994	Purbanchal University (PU)
98	1994	Nepal Engineering College (NEC)
99	1994	Manipal College of Medical Sciences
100	1995	Safa Tempo (Electric three-wheeler public vehicle)
101	1995	Ministry of Population and Environment
102	1996	The World Conservation Union, IUCN
103	1996	Ministry of Science and Technology (MoST)- Ministry of Env,S&T -MoST(2009)
104	1996	College of Medical Sciences, Bharatpur
105	1996	High Level Information Technology Commission
106	1996	Alternative Energy Promotion Center (AEPC)
107	1997	Pokhara University (PoU)
108	1997	Kathmandu Medical College
109	1997	Nepal Medical College
110	1997	Nepalgunj Medical College
111	1997	Nepal Telecommunication Authority
112	1998	Kathmandu Engineering College
113	1998	Kantipur Engineering College
114	1999	Centre for Energy Studies (CES), TU
115	2000	Dept. of Food Technology and Quality Control (DFTQC)
116	2000	Shikhar Biotech Co. Ltd.
117	2001	National Information Technology Center/ Government Integrated Data Center
118	2001	National Agriculture Research and Development Fund (NARDF)
119	2002	National Academy of Medical Sciences, Bir Hospital
120	2003	Information Technology Park, Banepa
121	2003	Real Time Solutions Pvt. Ltd.
122	2004	Nobel Medical College
123	2004	Lumbini Buddhist University
124	2004	Nepal Development Research Institute (NDRI)
125	2006	Technology Sales Pvt. Ltd., RamLaxman Innovations (Currently)
126	2007	Centre for Molecular Dynamics, Nepal (CMDN)
127	2007	National Information Commission
128	2008	Patan Academy of Health Sciences
129	2009	National Ayurveda Research and Training center (NARTC)
130	2010	Mid-Western Univeristy
131	2010	Far-Western University
132	2010	Agriculture and Forestry University
133	2011	Karnali Academy of Health Sciences

134	2011	Research Institute for Bioscience and Biotechnology (RIBB)
135	2012	National Innovation Center
136	2014	Kathmandu Institute of Applied Sciences (KIAS)
137	2015	Pokhara Academy of Health Science
138	2015	Center for Health and Disease Studies-Nepal (CHDS-Nepal)
139	2016	Nepal Open University
140	2017	Rajarshi Janak University
141	2017	Rapti Academy of Health Science
142	2018	Global Institute for Interdisciplinary Studies (GIIS)
143	2018	Nepal Applied Mathematics and Informatics Institute (NAAMI)
144	2019	Gandaki University
145	2019	Madan Bhandari University Science and Technology

Table 2: List of Overseas Funding Agencies

- Science Popularization Project ((IDRC, Canada)
- Teachers' Training (USAID)
- Radiation Laboratory establishment at NAST (USAID)
- Energy Efficiency Program (GIZ)
- Promotion of Renewable Energy Technology (GIZ)
- Disaster Management Practices (UNDP)
- Modernization of Traditional Technologies (UNDP)
- Achieving Sustainable Development Goals (UNDP)
- Nepal Climate Change Support Programme (UNDP)
- Seismic Vulnerability Mapping (UNDP)
- Post- 2015-Earthquake Reconstruction (UNDP)
- Technical and Vocational Education and Training (UNDP)
- Enhancing policy, planning and monitoring to achieve the targets of Education (UNESCO)
- Science and Technology National Database Updating (UNESCO)
- Prioritization in Science and Technology (UNESCO)
- Training on Traditional Building Architecture and Bylaws (UNESCO)
- Support for STI policy formulation (UNESCO)
- Protecting Nepal's natural heritage (UNESCO)
- Communication and Information, Safety of Journalists (UNESCO)
- Education for All (UNESCO)
- Awards, Fellowships, Trainings (TWAS)
- Region office for Tuberculosis in South East Asia (WHO)

- National Immunization Program (WHO)
- Science Awareness, Training and Workshop (IAP)
- Participation in Trainings, Seminars, Workshops (NAM S&T Center)
- Nature Conservation (WWF)
- Rainwater Harvesting (UN-Habitat)
- Biogas Support Program (FAO)
- Water, Sanitation and Hygiene, WASH (UNICEF)
- The Economic Viability of Jatropha Biodiesel in Nepal (World Bank Group)

5. Science Communication Approach and Role of Media in South Asia and Global Trend

Science communication priorities and needs are different for developed and developing countries. While developed countries are debating environmental effects, ozone layer depletion, genetically modified food as a priority issue, developing countries' priorities remain providing potable clean water, health and hygiene, conservation of energy etc. In developing countries, even non-illiterate people are inquisitive for evidenced based information on issues affecting their livelihood, but there is a lack of an attractive, catchy and effective communication to the level of their understanding. In developing countries, science communication has to compete to get the media coverage against political, crime, sports or business and films / entertainment, religious and superstitious programmes but experts believe this can be addressed by making science communication saleable by pitching on value-based information and subject matter of public interest.

Developed countries have institutionalised science communication initiatives with innovative approaches by creating new science communication avenues and online platforms which includes a range of public speaking, writing, journalism and social media initiatives and offer various fellowship and support to science writers. Science communication degree courses in the Universities are not limited to formal lectures anymore and use innovative formats, such as comedy, using props, powerpoint Karaoke or the form of a story and focuses on addressing gender and racial inequity. One of the hurdles is still lack of funding for science communication training. It is recommended that all science projects should set aside some funding for communicating science to the general public of their findings. In Canada, freelance science writing launched a podcast (e.g. Broad Science) and tried innovative formats (such as Wikipedia Edit-A-Thons) or utilizing your social media platforms (like @science.sam) to share exciting science news and related stories (Farah 2009).

An excellent review paper is published on science communication strategy and authors are referred to the article for details (Bubela 2009). Public communication for Science and Technology (PCST), an international network devoted to science communication has announced it will set up an academy to promote science communication, says Vladimir de Semir, chair of PCST (the International Network on Public Communication of Science and Technology). The academy plans to raise funds to support the network's activities in the developing world. It will also operate a regularly updated website that will gather information on science communication (Yang 2007).

In Asia, SAARC countries (Patairiya 2007; Goh 2008) are still behind from awareness of basic issues like clean drinking water, health and hygiene, conservation of energy and there exist a wide gap between scientific knowledge and community social needs. India is now considered one of the powerhouses of innovation and had set science communication strategy as early as 1987 with Bharat Jan Vigyan Jatha program BVJP. India has developed a number of outreach programmes through folk forms, digital media and hands-on activities like popularisation of HAM, Radio, origami and astronomy for different target groups teachers, students and marginalised people with low level of literacy in science communication. The Bangladesh Council of Scientific & Industrial Research (BCSIR) has also introduced

a program to develop social relations of scientists with the public, government, other organisations, foreign countries, and UN bodies, and publication of booklets, leaflets on various scientific discoveries and innovations.

The National Science Foundation (NSF) of Sri Lanka has a slightly different approach and its programmes are aimed at developing effective utilisation of science in daily activities, and developing understanding of science and technology to renew traditional beliefs, customs and practices in contrast to India's approach against superstitions and misbeliefs. Science programme for public understanding has been initiated under the theme 'Science for All' to raise science literacy at community level to benefit and appreciate the value of science communication. The NSF organises science magazines on TV, publication of Vidurava magazine, but in contrast science still remains an alien subject for common man in the developing world . Pakistan has adopted 'deficit model' of public communication of science and technology, which focuses to help people acquire knowledge of modern science and most of the science popularisation programmes science museums, planetariums, and mobile exhibitions, etc., but targeting mainly the literate audience.

Based upon individual countries experiences, the observations and analysis of the data available through various sources, following recommendations are being considered for an effective science communication in the region which broadly includes: Developing Regional network, South Asia Science Communication Forum, use of regional languages in science communication, identify strengths and best practices of every state, Govt and media commitment to support science institutions to train science communicators and science writers/ journalists/scientists, commitment to the goal of science communication as a unifying source for all member states, formation of Science communication wing as part of SAARC S&T Committee, devise exchange programme for students, science communicators, scientists and journalists in member states, regional science communication awards to encourage talented science communicators in the region, annual event, like regional science festival or congress, Joint regional training workshops on various aspects of science communication/science writing/science journalism, harnessing support from governments of member states and international organisations.

There were some notable achievements such as the recent agreement for S&T cooperation between some of the countries in the region, an increased participation of cross-national scientists, journalists and science communicators in various PCST activities and programs and are hailed as milestones achievements. Efforts to run India's Vigyan Rail / Vigyan Mail (Science Train: An S&T Exhibition on Wheels) also in Pakistan and Bangladesh to various destinations during 2004-2005 has attracted millions of people. SciDevNet, a UK based science and development web network, has started its South Asia Regional Gateway [www.scidev.net] incorporating information on science and development subjects of the region, thereby offering stronger science communication. India's Annual National Science Communication Congress and National Children's Science Congress offer forums for participation and exchanging views and experiences of scholars and students interested in PCST. However, it may be the rosy side of the picture and still there are many more miles to go together to achieve the desired level of public understanding of science; the countries in the region have to come closer for the purpose. This is only the beginning! We may look forward to better cooperation in PCST activities in the SAARC region in the years to come.

6. Non-Resident Nepali Media and Science Communication

Non-resident Nepalese Association (NRNA, www.nrna.org.np) which represents the largest Nepalese community representing 4.5 million Nepalese living overseas in 86 different countries has their own media channels, online and social media presence and impart influence on Nepali media. While the organisation is developing a long-term strategy for them in the S & T investment and Science Education campaign, science communication is not a top priority. One of the flagship projects of NRNA SKI Open University initiative [https://en.wikipedia.org/wiki/Nepal_Open_University] was to provide skill and science-based education outreach and effective science communication to the marginalised population of Nepal and was a welcome move. Nepal Science Foundation Trust (NSFT) also aims to promote science awareness campaigns through the "Science for the People" programs and assist in science capacity building, and lobbying at the policy level. Its science communication strategy included developing interaction programs with science teachers in schools, Science fellowships for media, and

science journalism award supporting science education campaigns. The initiatives also included environmental awareness study visit programs and promotion of the World science day activities and Science Olympiad (Fig. 1). Brain Drain seminar, a joint initiative with BSN and NAST also aimed to create an interactive forum between Nepalese and Diaspora's professionals to share R&D experiences and networking and support science communication.

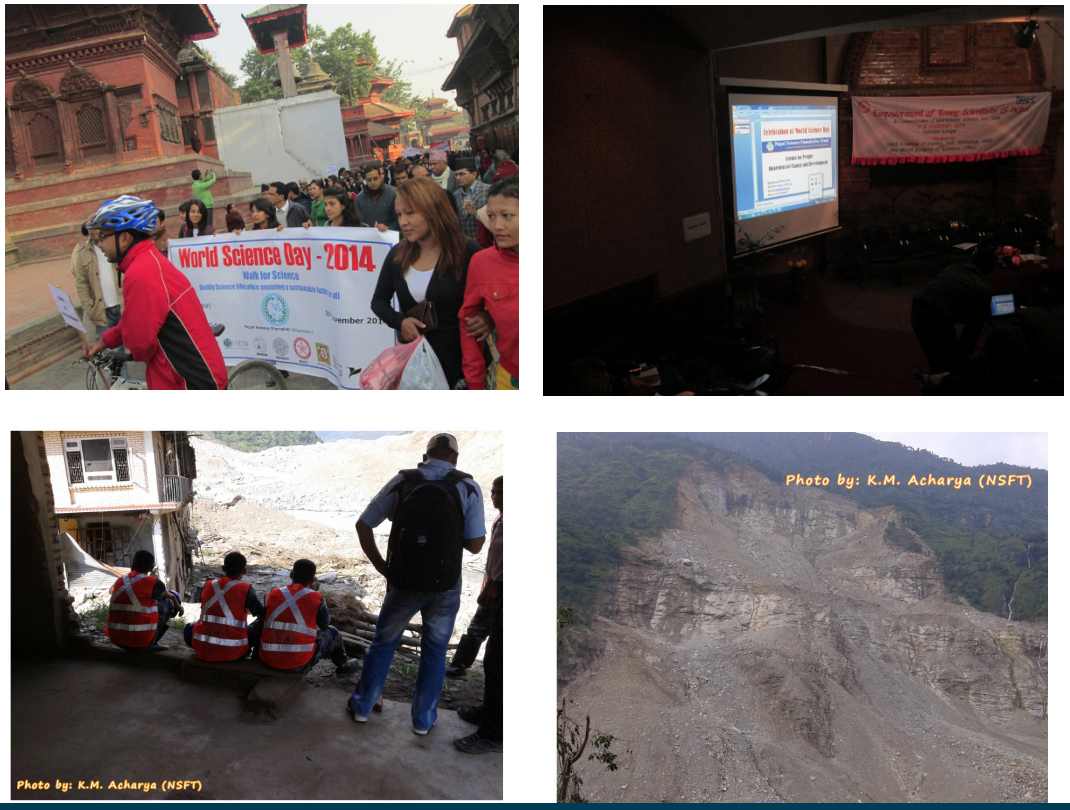

Fig. 2 : NSFT core activities and Jurie Landslide and environment impact study visit and World Science Day (Source: NSTF)

NRNA biannual Global Knowledge Convention main focus is also on application of natural sciences, advocating science policy , science education and communication. NRNA global conference [https://nrna.org] has provided key recommendations to science education programs and includes establishing an innovation endowment fund in partnership with the Ministry of Education, Science and Technology and NAST, and increased budget for science education and science communication. NRNA is also supporting the establishment of a science learning centre at NAST premises which aims to create a national forum for a science awareness campaign and communication.

7. Barrier in Effective Communication

There are still many barriers to effective communication to the general public. It requires many years of training and practice to make specialized knowledge and technical terminology understandable by the public. For example, climate change and pandemic issues have been communicated widely with a list of policies and activities for mitigating climate change and spreading the message of zero emission by 2050. However, it has created confusions while raising awareness about the issue due to conflicting news from both supporters and denial groups. Communication materials should be based on evidence as people interpret new information in light of their perceived beliefs, referred to as their mental models. In science communication one of the approaches has also been to conduct public surveys but such feedback needs to be statistically significant

with larger sample sizes. The feedback questions need to be designed to measure how well people know and understand the facts for making informed decisions.

The mental model's approach in communications recognizes that people need information that not only addresses their knowledge gaps and misconceptions but also builds on their existing beliefs. There is a need for interdisciplinary research involving scientific experts, social scientists and media experts, to promote development of more effective communication materials about scientific topics relevant to the general public. The resulting evidence-based communications are more likely to address what people need to know to make more informed decisions, allowing them to obtain better outcomes for themselves and the society in which they live.

8. Challenges and Opportunities

The history of the popularisation of science is driven by the philosophy that science is for the benefit of the people and to learn, safeguard, and make our universe most liveable. The world's diversity of cultures and level of education access and its assimilation is different . In developing countries like Nepal, modern science and technology and media both have failed to play a meaningful role in addressing the pressing needs of improved nutrition, drinking water, public health, safety, and shelter especially in regional and rural areas and in marginalized populations. The investment in S&T and science education had remained a low priority until today. Despite this, in the last two-decade, Nepal's connectivity to the world has increased exponentially even in remote parts of Nepal through access to smartphones and wireless internet. The people at all levels hold a mobile phone as a necessity and are now well informed and connected in all parts of the country. They are also connected to social media FB, WhatApps, Viber, TikTok, Instagram and have learned to realize how science can be helpful to their needs and other countries have benefited from the advancement and application of science. However, they are not aware of the investment and commitments countries have made to reach this stage and why Nepal failed to commit to science education. The perception of science in Nepal is still a complex subject and experimental driven which needs to be removed and awareness programs about the importance of science in daily life and science as fun and popular subjects need to be launched.

It would require much more concerted efforts to feed popular science communication to the public and especially children. The major competitors of science coverage in public are news and news-based programs which focus on political, crime, sports or business, drugs, violence, sex, films/entertainment, and now religious and superstitious programs dominate and science always remains in backseat getting almost insignificant attention. This situation can be changed by making science a saleable product through fun experiments, Quiz competitions, science exhibitions, talents programs, online teaching of popular science topics, interaction with scientists, sharing discoveries in print features, radio/TV programs, and the Govt should allocate a budget for all science institutions and schools. The private industry should also be encouraged to share their product's invention story alongside the advertisement. If a science story is told with a story and journalistic flavour, based on evidence, and flavoured with spicy examples and presented with vibrant dynamism by school children, celebrities from different fields such as cinema, sports, politicians, CEOs of the company, people will be attracted to science. There is a strong need to make science communication simpler and more attractive; and the real challenge is to stay focussed on literacy, practical, civic, and cultural aspects of science. The debates about important topics such as nuclear power or genetically modified foods, greenhouse, pandemic crises should also happen at the community level. Developing countries need to develop the mechanism for creating public debate that invites and involves people's participation and make them understand the impact of this confronting and emerging issues and the impact of science and benefit in day-to-day life. Otherwise, science still remains an alien subject for the common man in the developing world and is confined to the lab and elite scientific community. The awareness of basic issues like providing potable water, health, and hygiene, conservation of energy should be the priority areas for science communicators in the developing world. Also, what is important is an emphasis to produce a science program which is interwoven with elements of entertainment and public interest.

World science day should be declared a holiday. Scientists should be the real idols in real life for their real contribution to improving people's lives and making this world a better place. The life story of Nobel laureates should be shared to inspire young generations and how their discoveries have benefitted human mankind, Scientific research, and discovery is

described in the literature and is the foundation of future inventions and discoveries and should be explained in science teachings in secondary schools. Highlighting scientists and their work is one way, to re-foster trust in science and communicate to young people the importance of their contributions and set role models for doing public good (Fouad Laroui 2020).

UNESCO's initiatives on inclusive policy lab, open science, science education, and advocacy for science, are great and are aimed to take science to the grassroots to raise awareness about the pressing challenges like climate change, poverty and pandemic crises. Environmental conservation, biodiversity, and global warming narratives, and natural ecosystems and Nepal's rich geo-climatic and importance of mountains should be taught online using simple models to connect the science to students and community. Science popularisation can only be achieved by communicating success stories. Modern digital technology and social media connectivity is a great tool and platform to advocate and popularise the benefit of science. UNESCO should also translate their program into different languages in different countries and use visual media. Science popularisation can only be achieved by communicating success stories. Science and belief can co-exist. *Science is not the enemy of religion (UNESCO 2021).*

9. Conclusion

Despite increased initiatives, in the past two decades, Nepal's priorities for science campaigns are still very low and have failed to bring any visible impact or change the public perception of the importance of science education and S&T. Science still remains an alien subject for common man in the developing world. Government S&T funding has remained poor, barely 0.45% of GDP during the last six decades. By 2025, 40% of global employment in any industry would need at least an undergraduate level manpower and with the current priorities, Nepal is likely to fare poorly in this arena.

Twenty percent of the marginalized population still do not have access to basic education and are not able to understand science-based information. The World Trade Organization (WTO) has predicted that by 2020. Nepal needs to drastically increase the budget for science education and research proportionately and fast track S&T infrastructure development to benefit from science and join the global S&T race. Nepal S&T institutions and universities urgently need to commit to long-term strategies on science education campaigns, develop policies, priorities, and financial commitments, and make science education mandatory in school education to meet its millennium goals. Media has a greater role to play in championing the science education cause. Journalism diploma and degree should also include science journalism courses and will play a key role in advancing the cause of the science education campaign. Professional Societies also need to play a proactive role and join in this campaign. The NAST initiative to set up a National Science Park is a welcome step and such a park should be established in every state.

The NRNA and diaspora community can play a meaningful role to advance the cause of science education. There is a strong need to set up a joint innovation science education endowment fund between NRNA and the Ministry of Education, Science and Technology, GoN, Nepal Academy of Science and Technology (NAST) and develop a white policy paper on science education and communication in the next 5 years.

Recently PM Dahal reiterated his government's commitment to supporting the development of science and technology and it is hoped that science communication is included in this policy framework. The government needs to develop a national science communication policy and provide funding to bring and unite the efforts of Media, Industry, Scientific, and educational institutions both on and offline science communication.

Science education is inevitable in the 21st century. It is the root of knowledge which drives innovation and empowers people and countries with creativity to create new opportunities, address any pandemic and natural disaster crises to a path of prosperity. Science knowledge must be disseminated effectively to make people understand the value of science knowledge, increase interest, wider participation and society overall to benefit. Nepal must realize that time is running out for them to join the global race of knowledge power and science communication is one of the fundamentals to be part of this knowledge ecosystem. The country should make science education mandatory in schools and provide necessary infrastructure and connectivity to the global knowledge pool to skill and reskill our human resources.

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