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Abstract
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Practice and Thinking on Construction of Science Communication System of National Research Institutions——Taking Chinese Academy of Sciences as an Example

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Abstract: This study taking Chinese Academy of Sciences (CAS) as an example, analyzes the mission of national research institutions with regard to the construction of science communication system in the current social context. It reviews the science communication activities and construction practice of science communication system carried out by CAS for the benefit of the nation, the society, and for the scientific and technological innovation work of CAS. On this basis, it points out the necessity of constructing the science communication system of national research institutions and puts forward some relevant policy suggestions.

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In October 2020, the Fifth Plenary Session of the 19th Central Committee of the Communist Party of China stated that innovation remains at the heart of China’s modernization drive, and we will strengthen our science and technology to provide strategic support for China’s development. The new historical position of science and technology (S&T) in China highlights the practical significance of improving the public scientific literacy and risk management ability. As a major force in knowledge creation and national innovation system as well as a S&T force in national strategies, national research institutions have an inalienable historical responsibility in promoting S&T exchange and communication, national S&T innovation, and soft power construction. Therefore, how to build an efficient science communication system that conforms to the principles of science and communication and adapts to the requirements of the new era has become a pivotal question of our time. In this paper, we attempted to provide some references to solve this question based on the practice of science communication in the Chinese Academy of Sciences (CAS).

1 The historical context of building a science communication system by national research institutions

(1) Objective requirements for S&T development. The communication of science since its birth has played a critical role in S&T development. S&T can improve production and daily life directly through the transfer/transformation of S&T achievements, or indirectly by the popularization of knowledge and the improvement of public scientific literacy. Either way, science communication is necessary to realize the value of S&T. Additionally, science communication provides inexhaustible momentum for the sustainable development of S&T and society. During science communication, society continuously discovers and creates new demands for S&T, thus stimulating the iterative development of S&T. Meanwhile, science communication cultivates the reserve force for and thus driving the continuous progress of S&T innovation. As an important member of science community, national research institutions should continuously step up the research, exploration, and practice on the construction of a science communication system to promote the healthy and sustainable development of S&T.

(2) Inevitable choice for mission fulfillment. Science communication, associating with national S&T innovation and soft power, is an important factor in competing for speech right on S&T and improving S&T competitiveness. The socialist modernization with Chinese characteristics has entered a new stage, which requires implementation of a new development philosophy and construction of a new development pattern. Meanwhile, the accelerating pace of a new round of S&T revolution will reshape the global innovation landscape. The 19th National Congress of the Communist
Party of China stated that innovation is the primary driving force for development, and China is currently in a new historical position of self-reliance and self-improvement in S&T. General Secretary Xi Jinping clearly stated the requirements of striving to become the world’s main scientific center and high ground for innovation and S&T innovation and popularization being the two wings of innovative development. The national conference on publicity and ideological work clarified the missions to uphold socialism, rally public support, foster a new generation of people with sound values and ethics, develop Chinese culture, and build a good image of China. At a new starting point of history and as a S&T force of national strategies, national research institutions must undertake the publicity and ideological work of science community in the new era, and build a science communication system that matches the national innovation system. With the support of this system, they should actively disseminate scientific knowledge, spirit, and culture, enhance S&T innovation and soft power of China, and continuously gather the wisdom and power of the Chinese nation to serve the construction of an innovative country.

(3) Actual needs of institution development. While mirroring the soft power of research institutions, science communication is an inherent requirement for the innovation and development of these institutions. With the rapid development of S&T and the intensification of competition in the world, science communication largely affects the environment and opportunities of the development of industries, organizations, and individuals. National research institutions depend on both their own efforts and external support (efficient science communication) to maintain their strategic position as the national team. Internally, they should reach consensus on development and improve the management. Externally, they should build the image of institutions and gain public understanding and support. With the well-developed convergence media, the only way to better achieve the goal of S&T innovation and to play a better role in innovation-driven development is to tell our own story and receive internal and external acceptation of our values and philosophy.

2 Practice and experience of CAS in the construction of science communication system

CAS has always attached great importance to science communication and played a positive role in the cultivation of people’s scientific literacy and scientific culture. To meet the new requirements of development, CAS established the Bureau of Science Communication in 2013 to coordinate the news release, administration information, online propaganda, information disclosure, public opinion response, science popularization, and S&T publication, and listed science communication as an important task of Pioneer Initiative. Guided by the values of innovating S&T, serving the country, and benefiting the people, CAS achieved remarkable results in science communication after eight years of exploration and practice. Specifically, it preliminarily built a science communication system that reflects the advantages and characteristics of “Three-in-One” portfolio (cutting-edge research, strategic consultation, and higher education, backed by its research institutes, academic divisions, and educational institutions), embracing significantly strengthened science communication.

2.1 Adhering to national position and planning for long-term development

With the aim of building a national team for science communication, CAS actively fulfills the mission of science communication as a national strategic S&T force and deeply practice the national publicity and ideological work, finally establishing a “One-Three-Six” (One position, Three target functions, and Six specific tasks) scheme for science communication work (Figure 1). One position: building a science communication system reflecting the advantages and characteristics of CAS, with the innovation and framing development of CAS and the science communication in China.
communication system that reflects the advantages and characteristics of “Three-in-One” portfolio. Three target functions: building a good image, spread scientific culture, and improve efficiency. Six specific tasks: optimizing and integrating existing business, expanding information sources, creating excellent communication products, broadening communication channels, strengthening team building in CAS, and establishing and improving science communication work system. Practice demonstrates that this scheme has effectively guided the work of science communication by CAS and met the expectations of all parties.

2.2 Sticking to the goal-oriented approach and implementing the “Three Services”

Focusing on the above “Three target functions”, CAS attaches importance to strategies and plans and reinforces the working ability to ensure the implementation performance, and always serves the system construction and the activities of science communication.

2.2.1 Serving social development

Relying on rich high-end research resources, CAS performs science communication characterized by excellence and high precision, and strives to create an atmosphere of learning, loving, and using science in the whole society.

(1) Popularization of science. To foster people’s scientific literacy and culture, CAS developed a plan for high-end, leading, distinctive, and systematic popularization of research resources to promote the construction of science popularization bases, teams, products, activities, and platforms, and to serve the national strategic goal of science popularization. ① Supporting major national propaganda events. CAS served as the main hosts of National Science and Technology Week and National Science Popularization Day for many years, selected S&T innovation achievements to participate in the Five Years of Forging and a large achievement exhibition for the celebration of the 70th anniversary of the People’s Republic of China, and led the construction of the Scene of Great Country exhibition area in a large exhibition for the celebration of the 40th anniversary of reform and opening up. ② Building brand reputation. CAS created the Innovation Achievement Exhibition for the 70th Anniversary of Chinese Academy of Sciences, opened to the public more than 100 affiliated institutes on the annual Public Science Day, and hosted the popular science feasts of Science Festival of Chinese Academy of Sciences, SELF (Science, Education, Life, Future) Talk, and Annual Tour of Science and Technology Innovation. ③ Producing science popularization products and constructing science popularization bases. A total of 110 popular science books have been compiled since 2013, among which 25 books are selected as National Excellent Popular Science Works, and 3 books win the second prize of the National Science and Technology Progress Award. More than 400 science micro-videos have been produced, including 31 awarded as National Excellent Science Micro-Videos. A number of national science bases and S&T infrastructures have been built, along with the first batch of national patriotic education and demonstration bases as part of S&T infrastructures.

(2) Think tank communication. To make use of high-end think tanks and serve scientific decision-making, CAS reports suggestions on important topics of national S&T, economic, and social development. More than 2 800 issues of Special Report of Chinese Academy of Sciences and more than 170 issues of Brief Report of Chinese Academy of Sciences were submitted from 2011 to 2020 to provide think tank support for scientific decision-making. As an important platform for the publication of achievements of high-end think tanks, the Bulletin of Chinese Academy of Sciences has planned and published more than 100 major topics in recent years, which effectively support national major S&T strategies.

(3) Information disclosure. To fulfill the mission and responsibility of national institutions, CAS established a management system for information disclosure with clear duties and orderly divisions. From 2012 to 2019, more than 820 000 pieces of information were actively disclosed to the public. The number of original news of CAS increased from 3 245 in 2013 to more than 20 000 in 2020. At least one press conference was held each year at the State Council Information Office, and 198 requests for information disclosure from citizens and legal persons were processed and answered. These activities protect people’s legal rights to know, participate in, and supervise the work of CAS, and meet the actual needs of the public to be informed of the latest S&T progress and to participate in S&T innovation and development.

2.2.2 Serving S&T innovation

While strengthening research, CAS strives to produce an atmosphere, cultivate talents, and provide support for S&T innovation through science communication.

(1) Building first-class academic journals and national/international academic exchange platforms. Adhering to the correct political direction and publication orientation, CAS gives full play to the important role of publication in S&T exchange and international cooperation. ① Academic journals. Through reforms in integration of editorial offices and construction of high-quality journal clusters and digital platforms, CAS promoted the professional, excellent, international, and digital development of journal and book publication, and enhanced the quality and impact of S&T publication. By the end of 2020, there have been a total of 422 academic journals supervised or sponsored by CAS, accounting for about 8% of the total academic journals in China. Among these, 95 journals are indexed in SCI (39% of SCI-indexed journals in China). The number of journals in SCI Q1 increased from 16 in 2016 to 37 (46% of SCI Q1 journals in China) in 2020, and the number of top 10% journals of corresponding disciplines increased from 5 in
2016 to 19 (56% of top 10% journals in China) in 2020. In addition, an online proofreading system combining human and computer approaches has been developed in collaboration with China National Knowledge Infrastructure to screen papers for suspected academic misconduct and irregularities, which promotes the ethics of academic journals. ② Academic monographs. A large number of monographs representing the national level of S&T innovation have been published, of which more than 10 monographs win national book awards, more than 850 are supported by national key research projects, and over 1,000 copyrights are imported or exported, supporting the “going global” strategy of culture development.

(2) Promoting the spirit of scientific research. CAS selected and publicized a number of typical S&T research individuals and teams, such as Nan Rendong and Wang Yiping (Role Model of the Times), Wu Wenjun (People’s Scientist), Wang Daheng, Chen Jingrun, Liu Chuanzhi, and Pan Jianwei (Reform Pioneers), Li Pei (Most Beautiful Rose of CAS), Lu Yonggen (Touching China), brain scientist team, and Xu Ying (Beidou Goddess). The Science and Technology Festival—CCTV Annual Top Ten Science and Technology Innovation Individuals was initiated by CAS and CCTV and co-organized by China’s six ministries and commissions including Ministry of Science and Technology and Ministry of Education. In collaboration with the China Writers Association and the China Association for Science and Technology, CAS creates the reportage series of 70 Years of Innovation to Serve China, which has played a role in publicizing the innovation-driven development strategy and popularizing the scientific research spirit. In addition, CAS has always adhered to the scientific attitude of seeking truth from facts, and practiced and advocated the work styles of being rigorous and objective while avoiding suit-following, hype, and exaggeration, demonstrating an exemplary role in the science community.

(3) Cultivating successors of S&T innovation. CAS gathers high-end experts and research resources to implement the scientific education plan “Science and China”. The specific activities include organizing high-end science education seminars to build an exchange platform for international and domestic experts devoting to science education; developing high-level science education materials, courses, and laboratories for science education; training primary and secondary school teachers to educate more youths. Additionally, CAS publicized the model of Beijing Teenager Science and Technology Club in training young S&T talents.

2.2.3 Serving central work

Telling the story of CAS and creating an atmosphere conducive to reform and development are important tasks of science communication by CAS.

(1) Focusing on the Pioneer Initiative, CAS has planned and implemented two stages of multi-media communication. ① At the early stage of the implementation of Pioneer Initiative, CAS implemented a series of communication measures to gain broad support and consensus. Administration information publications were used to timely report the measures and achievements of Pioneer Initiative to the Party and the Central Government. The cooperation with mainstream media led to three consecutive rounds of publicity on the meaning and connotation of Pioneer Initiative at multiple angles, forms, and levels. The CAS-affiliated media interpreted related policies. CAS institutes were mobilized and deployed to disseminate information, and guided to enhance the senses of mission and urgency to realize the “Four Firsts” (first realizing the leaping development of S&T, first building the highland of innovative talents, first establishing the top-level S&T think tank, and first constructing global top-class research institution). These measures stimulated the internal driving force of innovation, reform, and development. ② With the further progress of Pioneer Initiative, CAS continued the publicity of major supporting policies such as the “One-Three-Five” Strategic Planning (an agenda to strengthen the core competitive competences of CAS institutes: focusing on one clearly-defined development strategy, three major goals/breakthroughs and around five top priorities, which should be built on the traditional strengths and comparative advantages of the institute and adapt to the new trends of scientific development), institute classification reform, Three Major Outputs (major original achievements, major strategic technologies and products, major demonstration projects of achievement transformation), and Strategic Priority Research Programme. In 2015, the leaders of CAS introduced the basis of Three Orientations (toward global S&T frontiers, national major demands, and main battlefield of national economy) and the implementation of Four Firsts in the two sessions-e-living room of People’s Daily. The press conference of the 2017 annual work meeting of CAS introduced the progress of reform on the classification of four types of institutions of CAS. Meanwhile, CAS timely propagated the achievements of cutting-edge basic research such as cloning of monkeys by somatic cell nucleus transfer and Majorana bound states, as well as the advances of a series of major scientific projects. In practice, a multi-directional multi-faceted communication mode of major S&T projects and achievements has been established, namely combination of communication tasks centering on science popularization. From 2015 to 2018, for example, the five-hundred-meter aperture spherical radio telescope (FAST) was serially propagated from various aspects at seven major nodes of construction, and planned and systematic publicity was performed for scientific satellites such as “Wukong” and “Mozi.”

(2) Public opinion guidance and response. To meet the requirements of the Central Government on the guidance of online public opinion and respond to social concerns in a timely manner, CAS paid close attention to the public opinions on S&T and gradually established and improved the institutional mechanisms and regulations for public opinion.
response. By the beginning of 2019, the public opinion response system of CAS was basically established, and the standardization and timeliness of monitoring, notification, investigation, and information release after the emergence of public concerns were significantly enhanced, which actively maintained the dignity of science and the reputation of CAS and the science community. For example, in 2019, the rational voice of CAS was published in Nature. In 2020, CAS stood on the frontline of a world war of public opinion triggered by the COVID-19 pandemic and timely conveyed scientific and accurate information to the international community.

2.3 Relying on the advantages of organizational system and strengthening organizational support

(1) Promoting team building. In virtue of the advantages of the organizational system, CAS built a three-level management system of academy, branch institutes, and affiliated organizations surrounding the Science Communication Leading Group. CAS created a high-quality science communication team consisting of main, supporting, and peripheral teams, with both full-time and part-time experts. The specific measures include stimulating staff vitality by integration of existing science communication staff and institutions. The construction of communication departments in CAS-affiliated institutions such as the Science Communication Division of Dalian Institute of Chemical Physics and the Knowledge Management Center of Chengdu Institute of Biology has achieved practical results. Twenty-five talents were introduced through the Program for the Introduction of Excellent Talents for Journal Publication in the Chinese Academy of Sciences, which met the needs of high-end talents for journal publication and science popularity in organizations affiliated to CAS. CAS made good use of professional organizations such as the China Science Daily and the Science News Center and promoted the construction of science communication research center, science communication research society, audio-video center, CAS history museum, and science popularization alliances, setting up a robust grid-shaped supporting structure. Besides, CAS performed comprehensive science communication training to improve the professional skills and occupational quality of the staff. Typical examples are as follows. In recent years, following the mode of Popular Science Lecturer Group of Senior Scientists in CAS, four additional groups have been established at the branch institutes with appropriate conditions. In 2017, the credit of science popularization was proposed for the first time in China to encourage postgraduates to participate in science popularization.

(2) Strengthening platform construction. Following the development of media convergence, CAS enriched the online publicity platform system and built a new media matrix to improve online science communication and provides high-quality information services to the public in a timely manner. Horizontally, CAS built an information release platform with one website, two ‘We’ platforms (Weibo and WeChat), and multiple APPs for external communication as well as mobile newspapers and electronic magazines for internal communication. CAS established science websites such as China Popular Science, Intelligent Popular Science, Astronomy of Universe, and Fossil, as well as Science Courtyard (WeChat official account) and new media platforms of popular science such as Weibo accounts of China Popular Science and Natural Science. From 2011 to 2020, more than 3.2 million messages were posted on the official website of CAS, with a total of 17 billion visits. The Voice of CAS new media platforms established in 2013 has released nearly 40 000 pieces of information, with a total of 1.7 billion visits. Vertically, CAS built a news release website group at the CAS and institute levels, and more than 600 new media accounts have been created by CAS-affiliated organizations, forming a platform cluster of new media. In addition, CAS promoted the construction of a standardized and efficient online management platform for the performance management, online project application and review, and event reservation of science communication.

(3) Enhancing resource construction. The leading Party member group of CAS attached great importance to science communication, which guaranteed science publicity. Policies such as the Notice on Strengthening Science Communication and the Opinions on Further Strengthening Science and Technology Propaganda Work have been issued, and sufficient funds have been dedicated to science communication.

(1) In terms of policy resources, CAS maintains business contacts with the Publicity Department of the Central Committee of the Communist Party of China and the Ministry of Science and Technology for timely guidance and support. For example, the Opinions of the Department of Science and Technology of CAS on Strengthening Science Popularity was jointly issued with the Ministry of Science and Technology.

(2) In terms of social resources, CAS strengthened cooperation with the China Association for Science and Technology, the Ministry of Education, and the Ministry of Culture and Tourism to obtain the necessary resources of financial support and training bases. For example, six departments, including the CAS and the China Association for Science and Technology, jointly implemented the Excellent Chinese Science and Technology Journals Action, and CAS-affiliated publishing organizations received nearly CNY 100 million of financial support each year.

(3) In terms of media resources, CAS strengthened the cooperation with mainstream media such as CCTV and People’s Daily, and obtained TV time and

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① Since the establishment of the Popular Science Lecturer Group of Senior Scientists of CAS 22 years ago, 32 000 popular science lectures has been delivered with a total audience of over 10 million.
journal page resources by jointly planning and implementing interviews and organizing the programs such as Journalists Walking into the Chinese Academy of Sciences. For example, CAS cooperated with CCTV to launch large S&T variety shows such as Artificial Intelligence v.s. Human Intelligence and I am the Future. In terms of content resources, CAS launched the construction of a database of role models to excavate excellent content for spreading.

(4) Consolating system foundation. Under the guidance of the Measures for the Management of Science Communication in Chinese Academy of Sciences, a science communication system has been established for news release, science popularization, information disclosure, public opinion response, and academic journal development. Meanwhile, a combination of various science communication rewards has been established, the toolset of work guidelines has been continuously improved, which jointly promoted science communication. For example, the Science Communication Award of Chinese Academy of Sciences has been established to encourage groups and individuals who have made outstanding achievements in science communication in CAS, and to stimulate the enthusiasm and creativity of CAS staff. The Science Star Journalism Award has motivated the enthusiasm and sense of honor of journalists to participate in S&T reporting. The Detailed Guidelines for Science Communication Performance Evaluation was revised three times to give full play to performance evaluation as guidance.

3 Reflections on the practice of science communication in national research institutions

Although CAS has made some progress in the construction of a science communication system in recent years, the system remains to be perfected according to the requirements of national innovation and development, the deployment of science communication work, and the demands for S&T innovation in CAS. Based on the practice of science communication by CAS, the science communication work of China’s national research institutions needs to be improved in the following three aspects.

(1) The knowledge and practice of science communication principles need to be further explored. Science communication in China is generally in its infancy, with insufficient research and practice. The current science communication system obviously does not meet the requirements of national innovation and development, and there is a long way to go. National research institutions still fall short in understanding and using the principles of science communication. Meanwhile, science communication tasks such as S&T publicity, science popularization, and journal publication have become increasingly arduous for the current work force.

(2) The requirements of reforming modern institute system need to be further matched. The Fifth Plenary Session of the 19th CPC Central Committee proposed improving the S&T innovation system and mechanism and (by 2035) achieving major breakthroughs in core technologies and becoming a front runner among innovative countries. The construction of an innovative country puts forward higher requirements for the governance system and capacity of modern research institutes, while the science communication system as an important part of the governance system does not match the requirements of system reform. Therefore, national research institutions should further emancipate the mind and take the lead to break through the mechanisms that limit the development of science communication.

(3) The working ability in the new media needs to be improved. With the revolutionary impact of the rapid development of information technology on communication pattern, multi-form science communication products have been generated through convergence media by national research institutions while are still needed to be expanded. The services cannot precisely provide information to different groups of people, with insufficient combination of multiple forms of media.

4 Recommendations for policies to promote science communication of national research institutions in China

New philosophy of development must be implemented as China enters the new era. To meet the strategic requirements of self-reliance and self-improvement in S&T, China should strive to become the world scientific center and highland for innovation. National research institutions must take the historical mission as the front-runner in the publicity and ideological work of science community, and strengthen the function and organizational support of science communication. In the framework of deepening the reform of research institutions and establishing a modern research institute system, CAS should fully explore the potential inward, build a more dynamic science communication system, and effectively use science communication as a basic link in the value chain of innovative China construction. Improvement can be expected from seven aspects.

(1) Complying with the requirements for the reform and development of modern research institutes, CAS should step up the deep integration of science communication and research and construct a big publicity pattern with all-staff, all-aspects, all-steps, all-orientations, and all-media.

(2) Relying on the advantages of organizational system, CAS should make full use of available resources to promote the horizontal convergence of the strength of professional organizations, while exploring the underlying principles of science communication to build a working mechanism that links and synergizes the organizations at different levels.

(3) Considering the current deep integration of commu-
communication technology and capital, CAS should cultivate talents for the industrialization of science communication and establish a more open and innovative working mechanism by benchmarking against National Aeronautics and Space Administration (NASA) and other top-class research institutions.

(4) CAS should keep introducing and training talents for the building of three professional teams: management planning, down-grading interpretation, and dissemination for science communication. Meanwhile, retired researchers, postdocs, and postgraduates should be encouraged to participate in science communication.

(5) Firmly grasping the profound connotation of “the great transformations once in a century”, CAS should focus on the principles of S&T innovation and development and continuously improve the internationalization of science communication.

(6) CAS should attach great importance to the development of media technology and make good use of social media platforms to integrate into the strategic layout of national media convergence.

(7) Relying on advanced technologies such as big data and artificial intelligence, CAS should continuously expand the database of role models and realize precise communication according to the specific needs of different populations.

References


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