#FACTORY WISSKOMM

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PROSPECTS FOR ACTION FOR SCIENCE COMMUNICATION

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Thanks to the participants

With their drive to improve the world through innovation, their curiosity and their profound understanding of interrelationships, scientists are in a particularly unique position, with the ability and the obligation to allow others to participate in their discoveries. As a result, they enter into a dialogue with society; this has important implications for social cohesion, for the acceptance of wide-ranging funding for research and for the necessary openness to all things new. The COVID-19 pandemic has highlighted to us clearly the degree to which all our lives are shaped by the interrelationships between science, society, media and politics, and the importance of communication about, by and with science.

But are scientists who are committed to communication receiving sufficient recognition for their work? What support do they need in order to be able to fulfil their task? And how can the future of serious science journalism be secured within the context of an increasingly tough media industry?

In the preliminary paper on science communication issued in 2019, the Federal Ministry of Education and Research made a commitment to support and fund further work on this issue. I therefore initiated the #FactoryWisskomm "ideas factory" project in September 2020, bringing together around 150 experts from science, journalism and foundations to discuss and develop specific recommendations for the science communication of the future. All those involved were united by their strong commitment to this area.

We can be proud of their tremendous theoretical and practical expertise. We now need to develop an even better understanding of the interrelationships and interactions between science and society in the context of the major challenges of our era, and play our part in these with structural support and targeted funding.

#FactoryWisskomm has taken a participatory approach from the very beginning. At the launch event on 28 September 2020 at Westhafen in Berlin, we jointly identified six areas for action and established working groups to address these. I am very grateful that outstanding individuals from the German scientific community undertook to act as specialist advisors for these working groups. Thanks are also due to the group spokespersons, who have coordinated the working groups with great commitment and led them through the process. The present "Prospects for action" have been developed over the course of several months of, in part, extremely intense debate. Each working group has authored their own chapter independently. The process has highlighted the diversity of and, to some extent, the contrast between different opinions on the role of scientists as communicators, and also the variety of approaches. A particular strength of the present recommendations is that they reflect this broad spectrum, and the editorial team is to be congratulated for introducing readers to this diversity.

I offer my warmest thanks to all those involved, both in public and behind the scenes, for their intensive collaboration and for their tireless commitment to #FactoryWisskomm. I am certain that science communication in our country will continue to reap the benefits of these "Prospects for action" for a long time to come.

Where do we go from here? All the organisations involved, and indeed all those interested in science communication, are invited to draw inspiration from this storehouse of tools and ideas. The Federal Ministry of Education and Research has already started to implement the first recommendations. May many more follow. A vibrant and lasting democracy and successful coexistence in the 21st century calls for a close network of relationships between science, journalism, politics and citizens. #FactoryWisskomm gives fresh impetus to this endeavour.

Anja Karliczek
Member of the German Parliament
Federal Minister of Education and Research

Introduction

Perspectives of #FactoryWisskomm

#FactoryWisskomm is a forum that has developed recommendations for science communication. It is notable for its wide diversity of perspectives and approaches, and it offers a storehouse of tools and ideas for the further development of science communication in Germany.

#FactoryWisskomm considers responsible science communication to be an integral element of the science system. Science communication is subject to the same standards and expectations as are applied to high-quality teaching and research: its content and methods are characterised by integrity and it is relevant, readily comprehensible and transparent. It is research-based and accordingly also engages in reflection on how it achieves success and how it impacts science and society. Science communication emphasises dialogue and debate, which includes engagement with the public. Its remit is not only to convey scientific methods and findings, but also to assist with bringing social issues and problems to the attention of the science system. It draws distinctions between the different formats of scientific briefing, dialogue, public engagement and public relations.

Communication and interaction promote trust. Research can acquire greater relevance and effectiveness through communicative reconnection with society, politics and industry. Owing to the high level of responsibility the activity entails, science communication should be bound by ethical principles; these should also be explicitly taught.

The contributions of different experts and different scientific disciplines to the solution of complex problems may be mutually contradictory, and therefore need to be communicated in a transparent and comprehensible manner. In order to help people to classify and evaluate this information, it is important to explain the approaches employed by research, which can never establish definitive truths, but draws its strength primarily from its inherent awareness of problems and its scepticism. Science communication keeps its distance from personal value judgements. In certain circumstances, good science communication means communicating less rather than more.

Science communication is a process between scientists, communicators, journalists, stakeholders within civil society and the public, and it is integral to scientists' self-understanding. Researchers decide for themselves whether and how intensively they will engage in activity in this area. Their institutions offer support and recognition for science communication. All those involved have a shared responsibility to engage in good practice, and they all demonstrate mutual respect. In order to honour the democratic requirement for participation, science communication formats should be shaped in such a way that they are open and accessible to the whole of society. As a result, the offerings available are diverse and are intended both for those with a high level of interest in science and those who have previously had little experience of science. The provision offers the opportunity to engage with critics.

Science journalism constitutes an independent supporting pillar of good science communication: it assists society in understanding, evaluating and taking account of scientific developments through skilled and independent observation of science from an external standpoint and with an awareness of social expectations.

A key objective of #FactoryWisskomm is that all those involved in science communication should engage in continuous professional development. This not only includes the continuous, research-based development of their own specialist expertise, but also their communication skills. The strengthening of these skills will be supported by suitable structures, the sustainable development of resources and a constructive culture of errors. Support and funding for science communication should become more firmly anchored in the science system – from large organisations, such as the academies and research institutes, through to individual higher education and research institutions and research networks.

Background

The spectrum of science communication ranges from communication from within science as well as communication to science, through social debates with and about science, communication conveyed via editorial media and digital platforms to the purposeful participation of citizens in research processes.

Since the PUSH Memorandum of 1999 ("Public Understanding of Sciences and Humanities", issued by the Stifterverband, a joint initiative by German companies and foundations, in conjunction with the major scientific bodies), science communication in Germany has undergone significant further development, and has produced a range of guidelines such as those by the "Siggener Kreis" circle of scientific communicators on good science PR. Communication is an essential part of the work of scientific institutions. As an element of scientific self-organisation, it is practised alongside scientific investigations and constitutes criticism of scientific research methodologies. However, the preservation of scientific autonomy, which is characterised by a high degree of heterogeneity and division of labour, remains key. This shared understanding is demonstrated, for example, by the 10-point plan published by the Allianz der Wissenschaftsorganisationen, the German Alliance of Scientific Bodies, in 2020.

Science permeates practically every area of life. Researchers are making discoveries every day which have immediate relevance for people's lives; the significance of other discoveries only becomes apparent decades later. The democratic process is founded on knowledge. Citizens, organisations and institutions have a desire to critically reflect on scientific findings on the basis of good-quality information, in order to make informed personal decisions on a firm foundation. Good science communication underlies this process – as has been clearly highlighted during the COVID-19 pandemic.

Digital platforms are pluralising the options for exchanging information and opinions. However, they also favour the formation of filter bubbles and the conduct of disinformation campaigns. Science and science communication can only make a limited contribution towards addressing social polarisation and fragmentation. Digital platforms are giving rise to new possibilities and formats for communication, yet they are simultaneously endangering existing journalistic business models and the discourse-ordering function of journalism, and hence that of science journalism as well. Science, science journalism, politics and funding bodies are all jointly tasked with countering this trend through innovation and supportive, independent structures.

Many different parties are engaged in dialogue and intellectual debate with social groupings: scientists, science communication researchers, the communications departments of higher education institutions, research institutions and research funding organisations, science journalists, political figures in ministries, administrations and parliaments, the members of clubs and associations, education initiatives, foundations and museums as well as further intermediaries such as bloggers and YouTubers. #FactoryWisskomm reflects the diversity of these roles and perspectives. Diversity and creativity are major strengths of this field, offering the potential for innovation that is necessary to tackle the challenges of the coming decade.

#FactoryWisskomm: Participants, methodology and target audience

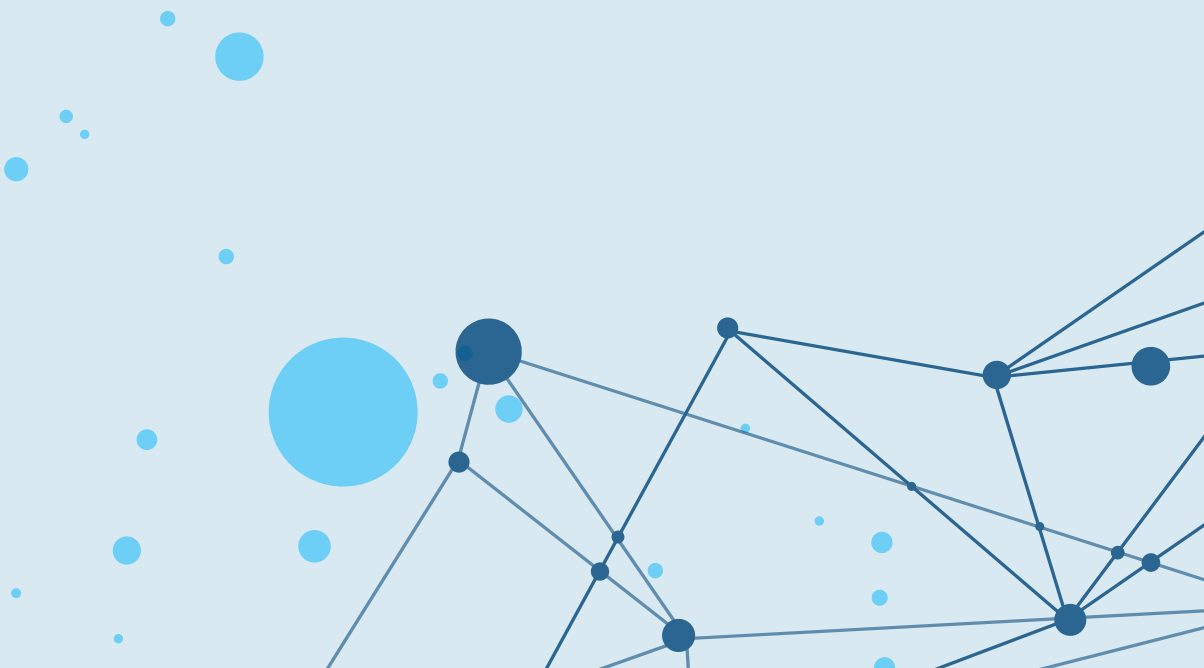
The Federal Ministry of Education and Research launched the #FactoryWisskomm strategy process in autumn 2020. The aim of the process is to anchor science communication more securely within the scientific landscape and amongst intermediaries than it has been to date. In the months leading up to April 2021, over 150 experts from the realms of science and communication worked to develop recommendations for the achievement of objectives and implementation of findings in six key action areas. The experts included scientists from different disciplines, directors of scientific bodies and museums, (science) journalists, science funding bodies, foundations and other stakeholders from the field of science communication.

The objective of the "Prospects for action to promote science communication", presented at the #FactoryWisskomm plenary meeting on 20 April 2021, is to further develop and strengthen science communication in the coming years. "Prospects for action" provides a storehouse of tools and ideas to further develop science communication. Practical recommendations play a vital role here in promoting responsible and sustainable interaction between science and society. The aim is to further improve our understanding of the diverse interrelationships between science and all areas of society, to strengthen these and to continue to develop them in a process of critical engagement.

Important objectives include enhancing the standing of science communication within the scientific community, establishing a culture which is more favourable to science communication and improving the structures which currently exist to support scientists who wish to share their knowledge with society. The #FactoryWisskomm participants will disseminate the present recommendations to their professional contexts and to the public; the directors of scientific organisations and funding bodies, in particular, will deliberately treat science communication as a strategic task.

The target groups for the present "Prospects for action to promote science communication" are:

- Stakeholders in the scientific community (from researchers and teachers, their institutions of higher education and institutes, to communicators and funding bodies)
- Stakeholders in the education sector (within which the transmission of basic knowledge of scientific processes needs to be improved)
- The media (journalists, intermediaries, e.g. bloggers)
- Relevant public institutions (e.g. museums)
- Politics (parliaments, ministries, administration)
- Civil society (citizens, clubs, associations, education initiatives and many more)



Working group themes

At the launch of #FactoryWisskomm on 28 September 2020, six key action areas were defined at the plenary session; working groups were formed to address each of these. The "Prospects for action to promote science communication" are the result of an intensive, creative process of dialogue within the working groups and the plenum. Key findings are detailed below, and then presented in greater detail by the working groups in the subsequent chapters.

Science Communication Competence Development Working Group

Competence development is essential to securing and enhancing the quality of science communication over the long term. The concept of science communication competence encompasses both scientific competence and communicative competence. Higher education and research institutions should facilitate and promote the improvement of competence at all educational and career stages. The overview of existing training opportunities compiled during the #FactoryWisskomm project should be converted into a larger database, made available online and continuously updated. Regular exchanges about offerings, best practice and quality assurance help build science communication competence.

Reputation and Recognition of Science Communication Working Group

In order to further enhance the reputation and recognition of science communication, we recommend that scientific institutions employ and continue to develop a strategic approach. This starts with guidelines for a culture supportive of science communication, to be modelled at director level; it progresses to supportive measures at all career stages, especially early-career, and provides examples of diverse forms of support, as well as possible further development of governance structures and funding conditions (for concrete examples and suggestions, see the chart on pages 25–29, which links action areas with action levels).

Science Communication as a Field of Research Working Group

We consider the appropriate strengthening of the research landscape to be an essential precondition for the development of science communication. Research on science communication focuses on the communicative relationships between science and society; this encompasses both the conditions for success in science communication and its consequences. Its findings form the basis of political, scientific and social processes of knowledge formation and decision-making. This presupposes that research can proceed in a stable and orderly manner, picks up on international developments and can draw upon debate in different disciplines.

Quality in Science Communication Working Group

Over the past 20 years, there has been a significant increase in the number and scope of formats for science communication in Germany. In accordance with the objective of ensuring good scientific practice, ensuring good science communication is a central aim of stakeholders in the field of science communication. To achieve this aim, they should agree on guidelines for quality assurance in science communication within a suitable framework. Strengthening impact research as well as strengthening dialogue between research and practice supports this objective by supplying a more substantial evidence base for science communication.

Science Communication and Participation Working Group

The science system should – with the support of politics – initiate and promote a cultural shift towards science communication in which participatory formats – known as public engagement – play a key role alongside informational approaches. Long-term funding lines are required for this purpose, together with appropriate change processes and further professionalisation of participatory science communication. An important first step towards this is developing scientific institutions' communication and transfer offices into centres of participatory science communication. Of equal importance is the active involvement of members of civil society in suitable communication and research projects and on advisory boards, as well as the establishment and strengthening of intermediary locations and individuals. The implementation process consists in enabling those involved to self-determine their participatory formats, and in deliberately selecting formats that include people from all social and cultural backgrounds.

Science Journalism in the Digital Era Working Group

Science journalism is of systemic importance to good science communication. It alone is in a position to act as a competent and independent external observer of science, with an awareness of social expectations. This discourse-ordering function is under threat from the disintegration of business models and the proliferation of non-journalistic digital media formats. The working group has developed specific options and opportunities for collaboration to promote successful digital transformation within science journalism. The opportunities described range from research and innovation policy, skills development and support for early-career professionals, intermediaries and funding structures through to systemic changes.

SCIENCE COMMUNICATION

COMPETENCE DEVELOPMENT

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Overview

The starting point and focus of the Competence Development Working Group is science communication in the interest of the public good (or "public-interest" science communication), that is, science communication that serves to benefit society first and foremost, rather than being primarily governed by particular institutional interests. Developing the competencies required for this purpose is essential to ensuring and enhancing the quality of communication. Our aim is to make communication better. Increasing the quantity of communication takes second place to this objective.

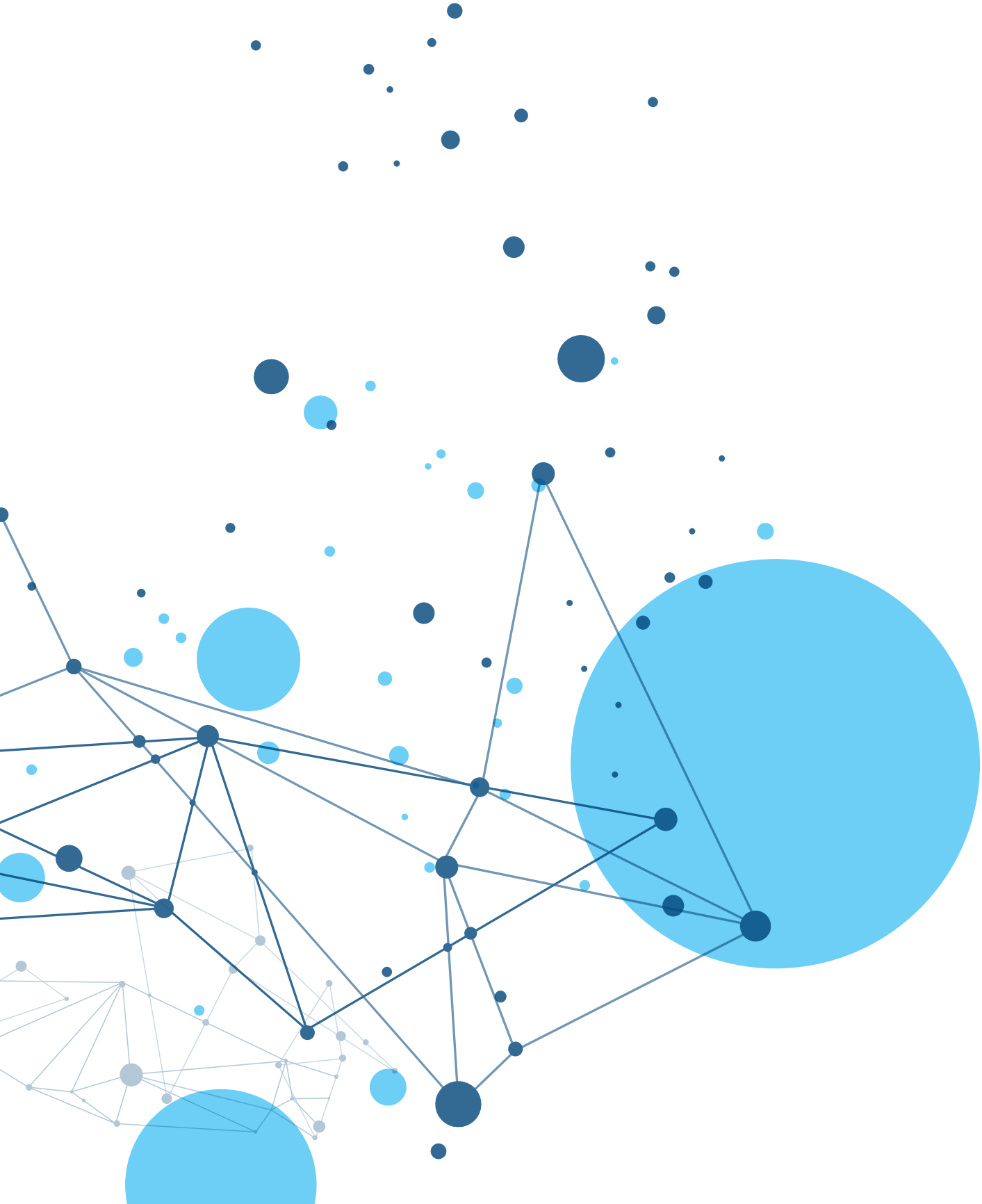
We define science communication competence as incorporating both scientific and communicative competence. Both dimensions should be considered during the improvement process. Reflection on the self-image of science (incl. ethics of science, sociology of science), knowledge of the principles of good scientific practice (incl. methods) and knowledge and awareness of specialist topics all come under the heading of scientific competence. Communicative competence consists of media skills, target group awareness, willingness to interact and engage in dialogue, and the ability to communicate in difficult situations (e.g. about controversial topics).

We believe that institutions of higher education and research institutes have an obligation to facilitate, support and ensure access to competence development at all educational and career stages. This does not mean that all scientists have to communicate their work to the public and the media. Rather, voluntary opportunities should be established for different target groups. Starting with undergraduate students, key areas such as good scientific practice/propaedeutics and media skills should be addressed first. At the doctoral, postdoctoral and professorial levels, the focus will then be on improving science communication competence in the more specific sense. In the process, and given the potential for careers in science journalism, options for a closer association between the training of early-career scientists and early-career journalists should also be explored.

A key concern for competence development is to foreground general communicative competencies, rather than skills aligned with particular formats, whose long-term relevance is uncertain. General communicative competence also encompasses explaining scientific approaches, methods, opportunities, risks and limits. In addition to general speaking skills of this type, students must also learn when communication is unnecessary or even counter-productive. The ability to listen, to place oneself in the position of target groups, to understand their perspectives and to enter into debate with (non-scientific) groups must also be addressed. The objective is therefore to achieve discursive competence that goes beyond simply conveying research findings.

With respect to competence development, course offerings at higher education institutions or research institutes and courses offered by foundations and specialist societies should complement one another. Various institutions offering expertise have already been successfully established to act as decentralised providers of science communication skills. The working group has compiled an initial overview of existing opportunities by means of online research. This should be converted into a larger database, made available online and continuously updated.

The quality of provision is of decisive importance for the development of science communication competence. We would therefore encourage the establishment of quality assurance measures, based on the current state of format development and on the latest research into science communication. Opportunities for debate should also be created, giving the opportunity to try out formats in a low-pressure environment and to obtain feedback from colleagues and experienced mentors.



Starting point and vision

Starting point

Science communication is increasingly recognised as a necessary intermediary between science on the one hand and the public and politics on the other hand. Strategies for, and experience of, communicating scientific processes and results are becoming a precondition for an increasing number of funding lines and competitions, whether for obtaining external funding or a professional position. Many scientists are now also engaging with the issue – many voluntarily; others, because it is expected. Communicative competencies support career progress and also enhance debate within, and in particular between, different scientific disciplines. Freedom to research also entails a responsibility to contribute one's findings to the process of public opinion formation. At the same time, in an increasingly technological, knowledge-based society, research can be extremely relevant to everyday life. Many issues require explanation by scientific experts. In accordance with its growing influence, science is being discussed more widely and more heatedly than ever before. It is in precisely this situation that science needs to take an appropriate stand.

However, the options for training and continuing education in science communication are not yet sufficient to meet this challenge. Although there are, on the one hand, supra-regional training providers for science communication and, on the other hand, options such as workshops and training modules at some institutions of higher education and research institutes, these are sometimes not very visible and are lacking in coordination.

To date, no comprehensive overview exists of training and continuing education opportunities in science communication; moreover, the opportunities that are available are extremely heterogeneous. While some provision addresses the respective objectives and actual needs of science and its dialogue groups, other training courses have an extremely operational focus. They relate almost exclusively to communication via particular channels and formats and are therefore limited to specific measures. Yet consideration of measures in isolation from the wider context discussed above may be ineffective and, in some circumstances, counter-productive.

Students' communication skills should be fostered, thus laying the foundation for the acquisition of further science communication competencies. In the later course of their careers, today's students may potentially become involved in science communication themselves. The possession of communicative foundations of this type is also an advantage outside active research – whether in academic institutions or in politics, administration, science management or in non-academic research departments and, last but not least, in journalism. They will be capable of explaining scientific topics within their respective professional and personal contexts. Issues related to science are discussed and communicated everywhere.

Most course offerings focus on postgraduate and postdoctoral career stages and exist alongside other key skills provision. If modules are taken, there is often insufficient time or opportunity to apply what has been learned in practical projects. The knowledge is then rapidly lost.

Established scientists and science managers should also have the option of further training in the area of science communication at any point. At this level, they will have an even greater need to integrate their own subject expertise and institutional knowledge into the framework of good science communication. Even individuals who do not actively seek involvement with the public may become the sudden focus of media attention and should be aware of e.g. how their subject is perceived and how media dynamics can affect public perception.

Professional communicators within scientific institutions can also play an important role in this undertaking. They can make a key contribution to the development of communication competence, either by delivering instruction themselves or by acting as coordinators of relevant courses at their institution.

Vision

Competence development is essential to securing and enhancing the quality of science communication over the long term. As a holistic concept, communication competence encompasses both scientific competence and communicative competence. It requires a solid basis of factual knowledge, specialist propaedeutics and an understanding of the principles of good scientific practice. To communicate science skilfully, you first need to understand and be able to reflect on science. Therefore, communicative competence essentially means the capacity to impart the object or content of the communication and the process by which knowledge is obtained to others outside the discipline. It also means listening and understanding other people's perspectives.

Within our vision for the next ten years, therefore, increased and higher-quality provision for the development of science communication competence constitutes just one element amongst others which shall jointly serve to ensure that science communication achieves a stable level of effectiveness.

The necessary opportunities for acquiring competencies should be accessible to as many scientists as possible, across all career stages. The initial focus should be on foundational scientific and communicative competencies, which are applicable to all scientists, even if they do not wish to become actively involved in science communication. At least a basic knowledge of public benefit science communication should be attained, simply in order to prevent miscommunication. In short, the aim is not to communicate more, but more effectively and in a more reflective manner.

Obtaining general media competence, as well as insights into how the media works, can be helpful to students no matter what their future career path. Thus, the establishment of suitable provision at every higher education institution is an important objective.

The heads of institutions of higher education and research institutes support the systematic development of science communication competencies. They consider that establishing these skills across the board will make a significant contribution to building their institutions' profile. Provision will be set up within all relevant individual institutions, or on a supra-institutional basis. Researchers will be encouraged and supported to make use of this. Mechanisms for recognising scientists who engage in science communication will also be established.

In addition to the ability to engage in public benefit science communication that is appropriate for the respective medium, it is also important for scientists to acquire discursive skills. This will, on the one hand, serve to promote a change of perspective such as active listening and, on the other, strengthen consideration of communication with hard-to-reach target groups.

Our vision also extends to ensuring that training provision is subject to quality assurance. This includes regular updating with findings from science communication research as well as from other specialist disciplines, such as psychology, social sciences and communication sciences. Appropriate research transfer mechanisms need to be established for this purpose.

The area of competence development also includes options for exchanges of experience with and between scientists, scientific journalists and communicators. A mentoring system available to all the different occupational groups will support mutual comprehension and interaction and will serve to further promote the common purpose of good science communication.

Recommendations for action

On the basis of the deliberations described above, the working group has formulated recommendations for action to promote the systematic development of competence within science. Competence development is essential to securing and enhancing the quality of science communication over the long term.

A key issue is the efforts made by higher education institutions, research institutes and scientific organisations to facilitate, support and make accessible **competence development** within their respective programmes **at all educational and career stages**.

Students should first acquire scientific competence in the sense of propaedeutics and specific subject knowledge, as well as an awareness of the principles of good scientific practice. In this phase, they should also learn basic media competence, which will enable them to understand media functions and mechanisms.

In the course of academic training, advanced courses for **graduates** should provide them with more in-depth knowledge of science communication. The key skills here include communication with specific target groups and reflection on communicative aims and appropriate tools. Furthermore, this training should encourage and equip individuals to engage in practical science communication. Graduate schools would appear to be especially appropriate venues for the development of competence.

In addition to course offers for students and graduates, provision should also be established that is specifically tailored to **researchers and lecturers** as well as to **the management levels**. Besides imparting skills, these continuing education and training opportunities also have the objective of reflecting changes in media, formats, etc.

Training courses should be continuously developed for the purpose of **quality assurance**. They should correspond with the latest research in science communication and should also address current developments in media and discursive formats; they should also provide teaching materials on new communicative formats. Thus it is essential that the **theory and practice of science communication** are interlinked. In addition, **recommendations** concerning quality standards for further education and training should be developed.

For these recommendations to succeed, **regular exchange** between directors and managers, scientists, communicators and further education programme coordinators at the respective institutions is important – covering demand, internal, external, in-house and co-operative provision, best practice and quality assurance.

Specialist **professorial chairs** shall also contribute their expertise in relation to propaedeutics and training in good scientific practice. Chairs and institutes for science communication (where these exist) or other relevant disciplines shall contribute their expertise on theory, reflection and transfer to the process.

Responsible professors, in collaboration with the **science managers and coordinators** of graduate schools, tenure track or postdoctoral programmes, etc. shall systematically review whether course offerings relating to public benefit science communication can be included in the portfolio on a **permanent basis** .

The **communications departments** of scientific institutions likewise have an important role to play in competence development. They can offer assistance and highlight the diversity of media trends, formats and stakeholders. Communications departments can also actively support scientists to communicate by providing occasions and frameworks for this to take place. Moreover, they can also advise scientists, and can provide support in adverse circumstances, where required. **Communications officers** should seek involvement or be included in the planning, design and, where applicable, the implementation of courses.

In order to encourage uptake of available provision to develop competence in science communication, we must raise **awareness** of the **options** and also ensure improved **recognition for scientists** involved in science communication. Directors and scientific managers should actively support the establishment of programmes at their institutions and encourage participation. For example, professors can promote these programmes to their students.

Specialist scientific societies can also help to raise awareness of these options. The need for science communication and opportunities for continuing education, training and networking can be discussed during specialist events and meetings.

Initial research into currently existing offers from a range of providers conducted for #FactoryWisskomm highlights, on the one hand, how difficult it is to find out about many of these. We therefore need to **improve the visibility of existing provision**. On the other hand, our findings indicate that there is as yet minimal networking between individual providers. Our survey should therefore be extended, and the results developed into a continuously updated, publicly accessible and user-friendly online resource. Opportunities for debate should also be created, allowing scientists to try out formats in a low-pressure context and to obtain feedback from colleagues and experienced mentors.

Provision for competence development in Germany

The Competence Development Working Group has commissioned initial research into competence development opportunities, with funding from the Federal Ministry of Education and Research. This research should be extended and consolidated, and the results disseminated. Providers should be able to contribute supplementary information themselves.

The database currently includes around 110 extremely diverse types of course offering:

- Provision at universities and research institutes, for example in the areas of key skills, graduate centres
- Courses run by supra-regional bodies such as the National Institute for Science Communication or science communication agencies
- Targeted summer school/winter school provision such as for example by acatech or Wissenschaft im Dialog
- Courses run by foundations – continuing education training for scholarship holders

Target groups for competence development modules and potential organisational location of training

Target group	Location	Example content
Undergraduate students	Key skills modules	Propaedeutics, good scientific practice, sociology of science, media resonance of own subject and general media competence, source criticism, awareness of algorithms ...
Postgrads, postdocs	Key skills, further education, postdoctoral and postgraduate programmes ...	Media competence, communicative competence, conceptualisation, individual formats and tools, opportunities to become involved in practical projects (open days, participatory projects ...)
Established scientists and science managers	Further education opportunities	Media competence, communicative competence, conceptualisation, individual formats and tools, camera training, crisis communication ...

REPUTATION AND RECOGNITION

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Overview

Introduction to the framework

Disseminating scientific findings and making these available for **discursive review and classification** is an essential element of the scientific process. This should not be restricted to specialist discussion amongst inherently scientific groups. Science and its methods, standards, working stages and findings should be actively communicated and discussed with society. Participatory formats should be more widely used for this purpose. In view of the significance of science communication for the relationship between science and society and the fact that further development of this relationship is a precondition for public participation in the democratic community, involvement in this activity should be accorded due recognition.

We recommend that this objective should be clearly and transparently stated and allied with a **commitment to individual and institutional recognition of, and support for, science communication**. Directors of the respective scientific institutions should put this principle into practice; it forms the foundation from which we have derived all the measures listed below – precisely in order that the commitment does not remain an abstract aspiration, but rather is implemented in concrete actions and sustainable strategies, depending on the differing local requirements, challenges and conditions of particular institutions.

Our **table** offers a **strategic framework** for achieving the objective of supporting science communication at all levels of diverse scientific and science-related careers, for improving recognition and enhancing the reputation of involvement in the area of science communication and also embedding this within organisational structures. The framework connects:

Action areas

- Science communication-friendly culture/culture of recognition
- Recruitment/career
- Staff development/enabling
- Regulations/governance
- Resources

and

Action levels

- Individual (junior level, senior level)
- Institutional (institutes, faculties, departments)
- Organisational (institutions of higher education, non-university research institutes)

This grid thus highlights both individual elements that are achievable over a short timescale as well as superordinate and more complex measures which could serve in isolation or conjunction with each other to promote the recognition of science communication and enhance its reputation over the medium to long term. It therefore facilitates the establishment of a strategic objective of integrating science communication more purposefully and sustainably as an important pillar of a comprehensive strategy for interaction and transfer with society.

Some of the proposed potential measures require greater flexibility in the applicable legal framework conditions; this issue needs to be addressed at state and federal levels – we have indicated this by noting "**see remarks on legal framework**". It should also be apparent that improving the culture of recognition and further developing science communication cannot be achieved without resources. Institutions of higher education and non-university research institutes require substantial and long-term support from their funding agencies for this purpose.

The order in which the action areas appear in our framework is based on our conviction that it makes sense to start with the action area “Science communication-friendly culture/culture of recognition”, since appreciative actions and the existence of a culture of facilitation and recognition are essential preconditions for the successful implementation of all the other aspects (from “Recruitment/career” and “Staff development/enabling” to “Regulations/governance” and “Resources”).

We have listed **examples of potential methods** for the implementation of these objectives in practice. We hope that this comprehensive framework will offer multiple possibilities which every institution will be able to – but should not feel compelled to – put into practice, either in isolation or as a package of measures, depending on their precise structures and goals. Every institution seeking to change and improve the recognition and regard in which science communication is held will find **plenty of inspiration** here.

Action options

	Individual level		Institutional level	Organisational level
	Junior level	**Senior level**	**Institutes, faculties, departments**	**Institutions of higher education, non-university research institutes**
SCIENCE COMMUNICATION-FRIENDLY CULTURE/ CULTURE OF RECOGNITION	**Instrument** Public thanks and feedback **Possible measures** • Mentions by directors • Letters of thanks • Publications • Prizes • Preparation and archiving of media resonance analyses and additional indicators and products specific to science communication	**Instrument** Public thanks and feedback **Possible measures** • Mentions by directors • Letters of thanks • Publications • Prizes • Preparation and archiving of media resonance analyses and additional indicators and products specific to science communication	**Instrument** Personalised support and feedback tools **Possible measures** • Databases of experts • Social media stories/ YouTube channels for individual experts • Preparation and archiving of media resonance analyses and additional indicators and products specific to science communication	**Instrument** Self-monitoring and management of own science communication activities **Possible measures** • Anchoring responsibility for science communication at director level • Regular appreciation shown to science communication experts • Letters of thanks • Science communication prizes • Annual report, report to senate, university council/ board, to funding bodies and donors

	Individual level		Institutional level	Organisational level
	Junior level	**Senior level**	**Institutes, faculties, departments**	**Higher education institutions, non-university research institutes**
RECRUITMENT/CAREER	**Method** Selection processes (incl. appointments) **Possible measures** • Proof of science communication as an optional criterion when recruiting • Make science communication activities clear in CV, include references **Instrument** Career and staff development **Possible measures** • Individual careers advice for employment in science communication • Competence development (e.g. special modules during graduate education) **Instrument** Individual careers advice for employment in science communication **Possible measures** • Special "Junior Manager in Science Communication" module incl. science communication module • Credit points/ECTS for PhDs within the context of graduate schools • Presentation of science communication as an attractive alternative career path	**Instrument** Selection processes (incl. appointments) **Possible measure** • Inclusion of a science communication criterion in recruitment advertisements for professorships (see remarks on legal framework, p. 23) **Instrument** Career and staff development **Possible measure** • Training	**Instrument** Institutionalisation of communications expertise **Possible measures** • Provision of resources, through pooling of external funds/grants where applicable • Establishment of "Comms Hubs" to undertake/support science communication efficiently via synergies, with communications professionals (with backgrounds in the media and/or science) available to support project communication (with attractive conditions of employment, job specifications and opportunities for development) **Instrument** Professionalisation of scientists and communications professionals **Possible measures** • Continuing education and training delivered within institutions by centrally employed or departmentally based communications professionals and by external providers such as Wissenschaft im Dialog, the National Institute for Science Communication, press academies • Transparent overview of training opportunities • Certification • Cooperation/interaction with other institutions	**Instrument** Design of recruitment and appointment processes **Possible measure** • Inclusion of a science communication criterion in recruitment advertisements for professorships (see remarks on legal framework, p. 23) **Instrument** Design of job specifications and career development routes **Possible measures** • Establishment of permanent posts other than professorships from the postdoc phase onwards relating to science communication (with attractive conditions of employment, job specifications and opportunities for development) • Debate within HE institution or organisation on permanent posts and staff development (see remarks on legal framework, p. 23)

	Individual level		Institutional level	Organisational level
	Junior level	**Senior level**	**Institutes, faculties, departments**	**Higher education institutions, non-university research institutes**
STAFF DEVELOPMENT/ENABLING	**Instrument** Support during doctoral studies **Possible measures** • Support from mentors • Training opportunities (writing training, camera training, etc.) • Modules within a structured doctoral programme **Instrument** Financial support **Possible measures** • Travel grants • Printing subsidies, etc. **Instrument** Individual career path in science communication **Possible measure** • Hybrid posts (incl. phase during which research output is accumulated and more time is allowed for communication)	**Instrument** Creation of time and space **Possible measures** • Sabbaticals • Provision of resources (student assistants, agency staff) **Instrument** Support for, and recognition of, science communication as an element of scientific work and an applicable form of transfer **Possible measures** • Teaching/technical support for science communication • Provision of coaching, training, methodological training by communications departments • Science communication as a component of target agreements between scientists and institutions (see remarks on legal framework, p. 23)	**Instrument** Institutional support for science communication and transfer **Possible measures** • Decentralised support unit to assist with the organisation of events, development of websites, blogs, etc. • Collaborations with the National Institute for Science Communication, scientific forums, etc. **Instrument** Implementation of a science communication-friendly culture and structure **Possible measures** • Science communication as an element of onboarding processes • Training opportunities • Introducing master's students to science communication at study events during which various forms of communication are demonstrated in practice • Interaction and collaboration with external partners, e.g. museums and citizens	**Instrument** Support for scientists involved in communication **Possible measures** • Establishment of a defence unit within the press office to "have scientists' backs" and proactively protect them against controversies or journalistic misrepresentation • Establishment of professional science communication units to provide advice, infrastructure, etc. • Expansion/strengthening of communications departments • Central support unit to assist with events **Instrument** Development of science communication as a career path **Possible measure** • Establishment of (permanent) posts through the pooling of resources, DFG project grants, etc.

	Individual level		Institutional level	Organisational level
	Junior level	**Senior level**	**Institutes, faculties, departments**	**Higher education institutions, non-university research institutes**
REGULATIONS/GOVERNANCE	**Instrument** Access to a professional science communication service team/core facility **Possible measure** • Allocate time/funds for science communication advice	**Instrument** Access to a professional science communication service team/core facility (even during the research proposal drafting stage) **Possible measures** • Allocate time/funds for science communication advice • Inclusion in internal proposal review process	**Instrument** Commitment to science communication and interaction with society **Possible measures** • Mission statement • Principles of good science communication • Annual reports • Agile support structure through staff expertise in science communication **Instrument** Responsibility for, and distribution of, resources **Possible measure** • Not necessarily embedding grants within projects in the case of DFG/Federal Ministry of Education and Research-funded projects, but rather optionally pooling these centrally/non-centrally	**Instrument** Responsibility for, and distribution of, resources **Possible measures** • Resource pooling in the HE institution communications department or core facility • Support with submitting proposals, development of methodologies, etc. • Grants for science communication as an automatic element of an approval in the case of DFG/Federal Ministry of Education and Research-funded projects (as a component of the funding guidelines) **Instrument** Science communication as an area of directorial responsibility in scientific institutes **Possible measures** • Anchoring responsibility for science communication at director level • Regulation of compliance issues, e.g. when contracting commercial communications consultants

	Individual level		Institutional level	Organisational level
	Junior level	**Senior level**	**Institutes, faculties, departments**	**Higher education institutions, non-university research institutes**
RESOURCES	**Instrument** Material resources **Possible measures** • Special prizes for a variety of individual activities • Cover the cost of science communication materials (as facilitation) • Assistance with documenting and archiving products of science communication **Instrument** Time resources **Possible measures** • Relief from teaching responsibilities, e.g. via temporary reduction in teaching load (in the form of facilitation or remuneration) • Extension of contract for significant involvement • Support to reduce pressure	**Instrument** Material resources **Possible measures** • Salary supplement (as remuneration), similar to research allowance scheme • Covering the cost of science communication materials (as facilitation) • Assistance with documenting and archiving products of science communication **Instrument** Time resources **Possible measures** • Relief from teaching responsibilities, e.g. via temporary reduction in teaching load (in the form of facilitation or assistance with examination marking) • Relief from research responsibilities set out in target agreement • Sabbatical (as facilitation), e.g. to plan and undertake science communication • Science communication as a component of target agreements between scientists and institutions (see remarks on legal framework, p. 23)	**Instrument** Material resources **Possible measures** • Budget for staffing and allowances for science communication • Cover the cost of science communication materials (facilitation) **Instrument** Time resources **Possible measure** • Facilitate temporary substitutes	**Instrument** Material resources **Possible measures** • Facilitate material support • Science communication as a component of target agreements between funding bodies and institutions (see remarks on legal framework, p. 23) • Adaptation of core finance and project funding for science communication **Instrument** Time resources **Possible measures** • Protection of periods of time for science communication • Science communication as a component of target agreements between funding bodies and institutions (see remarks on legal framework, p. 23)

SCIENCE COMMUNICATION

AS A FIELD OF RESEARCH

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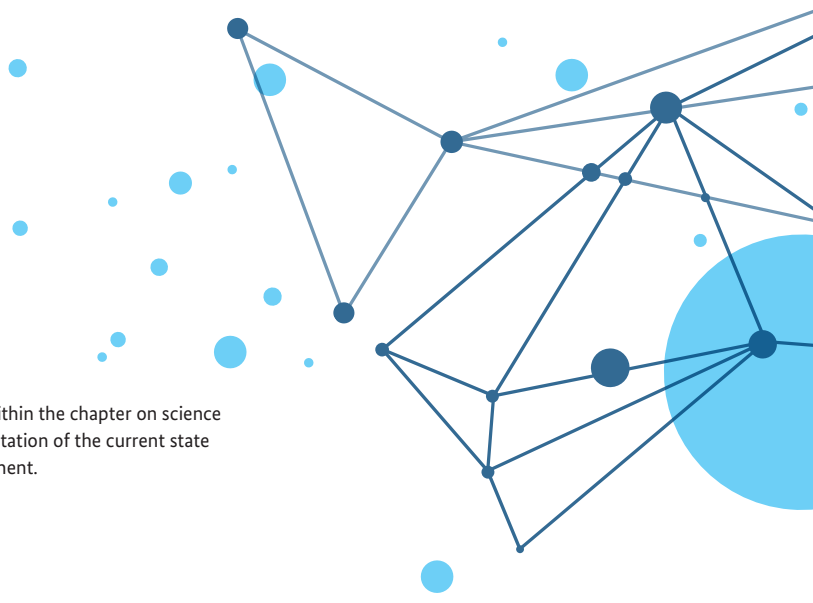
Overview

If science is to have a greater impact on society, then we need to understand the conditions within which this can take place responsibly and sustainably. **Research into science communication therefore considers its subject to be the communicative exchange relationships between science and society.** It aims to investigate these interactions using appropriate theoretical and methodological approaches. Research can serve to inform political, scientific and social processes of knowledge formation and decision-making and contribute towards critical reflection on these. Research into science communication thereby fulfils a democratic function, insofar as scientific knowledge is considered a valuable resource for social cohesion and progress. Research into science communication can only do justice to this if it is founded in stable and sustainable structures, picks up on international developments and is able to draw on the interactions between different disciplines and practical expertise. We consider improving the exploitation of current development potential for the benefit of the research landscape to be a key precondition for further shaping and strengthening evidence-based science communication overall.

Against this background, we believe the challenges to lie primarily in the areas of **expanding capacity and supporting early-career professionals, funding research, strengthening interdisciplinary and international networking and promoting productive interaction between science communication research and practice.** To address these challenges, we propose a series of recommendations for action that should be implemented in coming years by stakeholders involved in science, scientific management, research funding bodies, politics and practice, in order to sustainably strengthen research into science communication. This should be undertaken within the context of their respective roles and responsibilities and may, for some of the proposed recommendations, tie in with provision and structures that have already been put into place.[1]

The recommendations that follow represent the results of an intense working process within the Science Communication as a Field of Research working group. The working group included recognised experts in science communication research from a range of disciplines, representatives of funding organisations and professional science communicators. The vision and recommendations for action presented here are essentially based on a survey of the working group members, as well as in-depth discussions and votes within this circle of experts.



1 We have refrained from supplying bibliographical references within the chapter on science communication as a field of research, since a systematic presentation of the current state of research is impossible within the scope of the present document.

Starting point and vision

For science communication to succeed, the **individual, social and structural conditions for interaction between science and society must be analysed**. The objective of this area of research, which is based across a range of disciplines and has a broad international outlook, is to investigate public communication within, by and about science using appropriate theoretical and methodological approaches (e.g. with regard to the transmission of knowledge, trust in science or the understanding of science within the population). The findings of research into science communication make an important contribution to the moderation of challenges facing society, such as pandemics, climate change or digitalisation; in these cases, scientific findings (should) inform social and political discourse and the associated decision-making processes. The contribution that research into science communication can make towards understanding the complex relationships of interaction between science and society may be illuminated by a few examples:

- The continuing **digital transformation of public and private communication** enables every citizen to participate directly in processes of communication about science or originating from science. Although this digital transformation is associated with opportunities for greater openness towards society, it also poses challenges such as the greater prevalence and scope of politically motivated rejection of science. One of the tasks of science communication research is to analyse and understand these processes and ideally to also make predictions about these by developing theories and using models. It is worth bearing in mind that there is no such thing as "the public". In recent years, international science communication research has investigated how different segments of the population inform themselves about scientific topics. It became clear in the process that science communication practice has done little to address and reach those parts of the population with little personal connection with, or experience of, science and research. Research can and should provide an important impetus to do so.

- In this context, research also focuses on **stakeholders who communicate publicly on diverse scientific topics within a range of contexts and via diverse media channels**. Another important question for research is the respective contribution made by traditional communicators such as (science) journalists or university spokespersons as opposed to new mediators such as influencers, activists or bloggers, and their influence on the public visibility of science. A great deal of work has already been conducted in this regard in the area of climate change communication, for example. A solid basis of knowledge also exists within the field of health communication; this could provide important impetus for practice. Scientific analysis of these developments is also key, because increased communicator diversity can be associated with a reduction in the significance of journalistic quality criteria and/or may give rise to new quality standards for science communication. The most recent debates on science scepticism, misinformation and disinformation highlight the continued relevance of these topics. An important concern of science communication research is to critically reflect developments in these fields and to inform decision-making processes.

- Research can make a significant contribution to reflection within science **by asking about the retroactive effects of science communication on science itself**. The necessity of doing so becomes apparent precisely when a "cultural change" in science communication is demanded by politics; this concept should itself be subject to fundamentally critical debate. In this case, but also more generally, one task of science communication research must be to illuminate the prerequisites and contextual conditions of such a change, and to reflect on its functional and dysfunctional consequences. We regard this as a key issue for quality assurance in science communication. The example of climate change communication highlights that scientists' involvement with social problems contributes significantly to public awareness of these problems and to their being recognised as such. However, by doing so, scientists to some extent become political actors, or they are perceived as such, even though they do not regard themselves

as belonging to this category. This also gives rise to questions about the relationship between scientific norms such as objectivity or neutrality of objectives, on the one hand, and the demands for social engagement by scientists on the other. **Conceptual and empirical questions thereby arise for research, because the role of science in discourses on, and solutions to, social problems is a fundamental part of its remit.**

These brief examples highlight the range of potential problematics, and demonstrate that these arise to a large extent from the social practice of science communication. These are effectively problems that would still occur even if no research into science communication took place. However, it is only by conducting research into science communication that we become able to explain these problems, to debate them in an informed manner and to develop and apply potential evidence-based solutions to them.

Research into science communication is therefore able to **develop potential solutions for practice and to assess these empirically**. Thus, for example, we can use surveys to illuminate the relationship between knowledge and trust, explore the potential of participatory formats by undertaking case studies of citizen involvement in science, and conduct experimental studies into the effects of the emotionalisation of science communication, in each case thereby also contributing to potentially improving science communication practice, or to enhancing its effectiveness. These are the tasks of applied science communication research. The sample problematics outlined above also demonstrate, however, that many extremely pressing topics within science communication cannot be addressed solely by means of empirical studies, the development of indicators or the evaluation of measures. **Many of these questions can only be resolved, or at least addressed on an ongoing basis, by means of reflection and negotiation by the stakeholders themselves.** Examples include the normativity vs objectivity problem outlined above – that is, the question of the role that scientists should adopt when advising on politics and society – as well as the question of quality requirements in science communication. Another example is that the trust of population groups in science also depends on conditions which neither science nor science communication practitioners can influence to a significant degree. **It is therefore all the more important that stakeholders within the science system and within science communication are aware of these conditions.** Since they are not static, they must be continuously empirically described and subjected to repeated conceptual examination. Research into science communication can also draw attention to these types of problems, provide the theoretical framework for reflection upon them and supply empirical data concerning their boundary conditions. In their political and social advising, teaching and training activities, researchers from the field of science communication can contribute to managing expectations of its potential.

Of course, the contours of a science cannot only be defined by reference to the problematics and objects to which it relates. **Scientific fields have and need an independent existence, in the interplay of more fundamental and more applied research, in order to be capable of self-renewal and external contribution.**

It thereby becomes clear that research into science communication lays the foundation for a critical and reflexive communicative practice that also has impact. We therefore recommend the sustainable strengthening of the research field of science communication. The objective is a forward-looking (further) development and structural stabilisation of this interdisciplinary and internationally-oriented research field, that, both in its foundations and in its applications, provides important sources of inspiration for science, politics, practice and the diverse interactions between science and society.

Recommendations for action

The potential of science communication research to make a contribution to research- and evidence-based science communication depends on the sustainable development of the field. We present below a series of measures developed within the #FactoryWisskomm "Field of Research" working group that could support this strengthening of science communication research in both organisational and structural terms. The recommendations for action are particularly concerned with the systematic development of the research field with respect to capacity building, support for early-career researchers and the field's own science communication. The chart at the end of the chapter provides a summary of the recommendations for action.

Capacity building

We should strive to establish a science communication research field that integrates the research activity which to date has been undertaken within different disciplines, and that (e.g. as a sub-discipline of communication science) goes beyond previous efforts, depending on scope and disciplinary structure. An inter- and transdisciplinary field of research ought to develop from and with the existing individual disciplines, as well as a correspondingly-oriented scientific community (not a new subject). This does not mean that every stakeholder, every funding initiative and every research project needs to demonstrate this transdisciplinarity. Transdisciplinarity should rather be embodied within the sum total of the activities to be developed, as well as within the discourse spaces (e.g. specialist societies, conferences) of the research field of science communication.

The aspect of capacity building outlined here has the objectives of 1) facilitating high-quality inter- and transdisciplinary research; 2) networking relevant expertise; and 3) intensification of international interaction.

- **High-quality inter- and transdisciplinary research:** At present, research into science communication is supported on a project or disciplinary basis; the results are correspondingly fragmentary, insufficiently reconciled with other findings and often become bogged down in specialist debate. We therefore recommend the creation of a long-term framework programme (e.g. by the Federal Ministry of Education and Research) for inter- and transdisciplinary research into science communication. We also recognise the need for the development and expansion of institutional and staffing capacities for science communication research, appropriate to the respective roles and responsibilities of those involved (e.g. by expanding or creating new chairs or research groups or founding corresponding research centres).

- **Networking of relevant expertise:** In Germany, research into science communication is conducted in particular, but not exclusively, within the fields of communication science, psychology, educational science and teaching methodology, sociology of science, higher education research and also in practical science communication contexts. In these specialist disciplines, in turn, diverse approaches are taken to researching science communication; for example, we can observe a particular focus on communication with and about the natural sciences and medicine. In addition to, and in conjunction with this, research into the communication of the social sciences and humanities should also be intensified. Continuous reporting of science-related attitudes and trust in science amongst populations, for example via representative surveys, is also desirable; these surveys can study specific topics on a continuous, longitudinal basis as well as carry out in-depth investigations into current developments. An example of this is the "Wissenschaftsbarometer" public opinion survey conducted by Wissenschaft im Dialog; this could be expanded and consolidated. We can also see hitherto unexploited potential in funding accompanying research, by making specialist scientific projects and their communicative activities the object of science communication research in turn (e.g. as a funding option in specialist research areas). The development of the field of science communication research should itself be accompanied by empirical study and thus constitutes an object of scientific research itself. In conjunction with the inter- and transdisciplinary focus of research into science communication, we support institutional and structural networking

within the emerging research field. Interaction between the different disciplines and specialist domains currently engaged in research into science communication is limited at present; in Germany, the research field is fragmented. We recognise enormous opportunity in productive exchanges of expertise, in particular through the initiation of interdisciplinary networks and working groups, the strengthening of dialogue between relevant specialist societies and the creation of forums for discussion or particular research societies, through conferences or the founding of appropriate academic journals. Collaboration with established structures (e.g. the Network for the Public Communication of Science and Technology PCST, the Science Communication Group of the German Communication Association, the Science and Technology Research Section of the German Sociological Association) is desirable, as is ensuring scientific excellence, for example through the development of suitable peer review processes.

- **Intensification of international collaboration:** In other countries, research into science communication is already more established, sometimes under different headings (e.g. Public Engagement Research, Science of Science Communication). In Germany, by contrast, we are only seeing the gradual emergence of a research field that, on the one hand, will be able to benefit from international experience and, on the other hand, will be in a position to strengthen the European scientific and research landscape. Intensifying international networking will favour comparative research into stakeholders, processes and conditions for success in science communication, especially in view of the increasingly globally networked public sphere. Collaboration and interaction in science communication research can be facilitated and accelerated by means of special funding of institutions, initiatives and projects with an international focus, such as transdisciplinary international research groups, European conferences or specialist journals.

Support for early-career researchers

An important precondition for strengthening the field is sustainable and systematic support for the next generation of science communication researchers. A particular focus is the creation of training opportunities and career prospects for new researchers. We here outline a support proposal which contains three specific threads: 1) the establishment and institutional embedding of appropriate modules and course specialisms; 2) the establishment of transdisciplinary master's courses; 3) the development of transdisciplinary graduate programmes.

- **Foundational training in science communication – Establishment of modules and course specialisms:** Science communication is being accorded greater recognition within academic education, even if engagement in the area at German universities remains low by international standards. However, a series of specialised modules or focused courses already exist, under the auspices of a variety of different disciplines. In close conjunction with their studies of specialist content and materials, students can gain their first experiences of, and engage in, initial reflections on different forms, formats and challenges within science communication. This offers them the opportunity to understand science communication not only as a key area of scientific endeavour, but also as an extended area of professional activity and research. It also facilitates the early involvement of students in active science communication. This proximity to specialist subject education offers the advantage of individual consideration of particular challenges or opportunities. We consider it vitally important that content is not only developed with a focus on competencies and practical training, but also on the basis of the current state of research. In order to facilitate this type of module or course specialism, we recommend funding the creation of teaching materials, such as textbooks, as well as teaching and learning platforms, for example for the presentation of case studies and other educational materials. We also recommend that scientists from different disciplines have the opportunity to engage in further education and training in science communication.

- **Establishment of courses:** Explicitly transdisciplinary master's courses could be delivered in affiliation with suitable departments, centres or institutes. These will serve to offer in-depth teaching with an interdisciplinary and transdisciplinary perspective in the field of evidence- and research-based science communication. These courses will support the next generation of researchers in this area and will also provide scientifically-based training in the extended professional field of science communication (such as in the area of university support for science communication, as well as in the activities of non-governmental organisations, businesses, journalism or politics).

- **Postgraduate training and networking:** Finally, we propose the funding of transdisciplinary programmes for graduate and doctoral candidates according to scientific quality criteria, which will provide a systematic practical introduction to, and support for, research in the area of science communication for early-career scientists from all disciplines, as well as specialist courses. The aim here is to productively exploit the tension between necessary specialisation in individual subjects for the purposes of teaching and research on the one hand and the transdisciplinary nature of the research field of science communication, including the strengthening of integrative perspectives, on the other. We might expect that the next generation of scientists will themselves drive forwards integration and networking within the field, and that this will be reflected structurally in the establishment of associations of early-career researchers. The provision of funding by the scientific community or by funding organisations for these types of endeavours would send important signals.

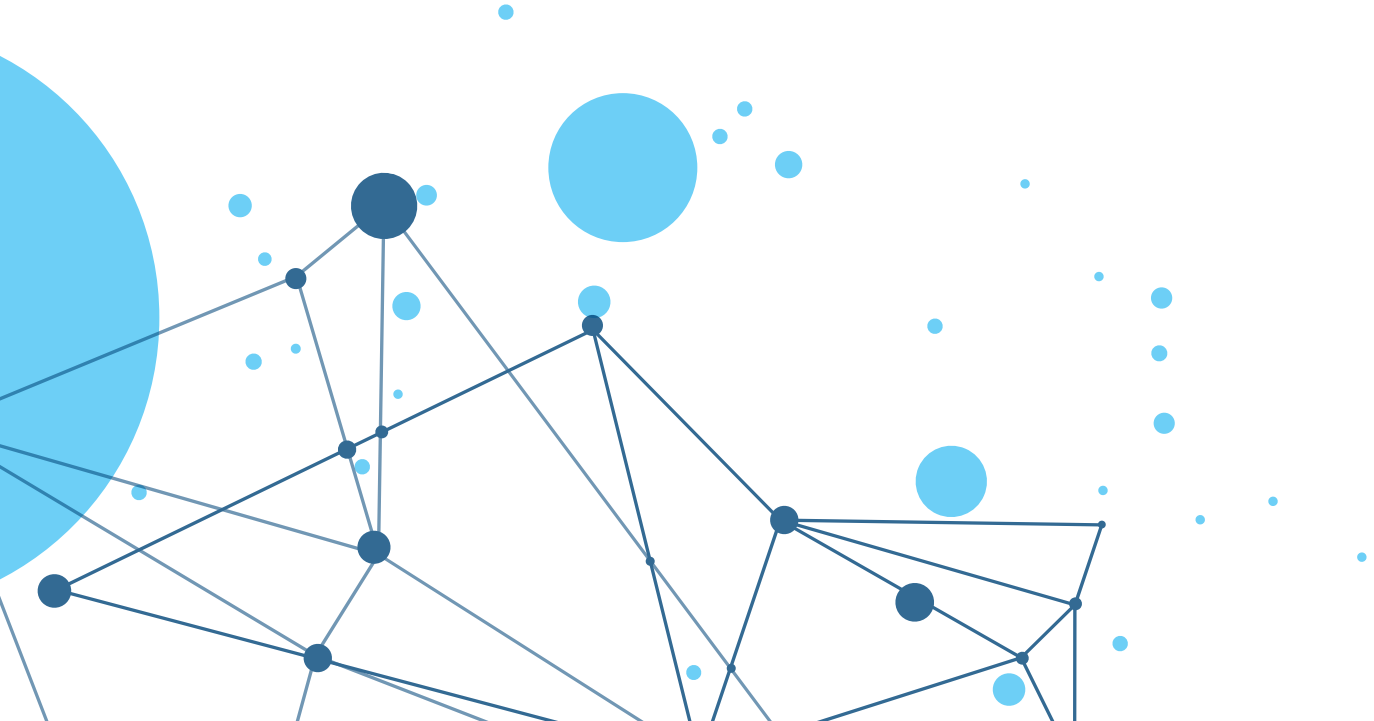
Communication of research into science communication

In order to shape the interactions between science and society in a sustainable manner for the mutual benefit of all, researchers and practitioners within science communication should in future engage in more intensive exchange than has previously been the case. The objective should therefore be the systematic development and promotion of science communication from within the research field itself, and the creation of the necessary institutional framework conditions to achieve this. In this context, the question arises as to how science communication research can shape the communication of its own knowledge in the future, in order to make a responsible and simultaneously constructive contribution to communication practice beyond the research field itself. The contribution made by the research field to science communication as outlined here has the objectives of ensuring 1) the quality of science communication and 2) effective interaction between theory and practice within the framework of evidence-based science communication.

- **Quality assurance:** For the purposes of quality assurance, we believe that particular funding should be provided for applied, practical research and reflection on structural and institutional questions of evaluation, quality assurance and embedding, as well as on the various scientific and professional reputation mechanisms and impact expectations in the field of science communication. In this matter, the research field of science communication is lagging behind its own demand to be institutionally embedded; the processes of embedding, obstacles to and opportunities for its occurrence have not been sufficiently observed, analysed or understood. This, in turn, requires that professional and practical expertise should be actively and equally involved in the scientific work of the research field (e.g. in the context of participatory research/real-life laboratories), for which institutional support must be provided, in the form of exchange, sabbatical or fellowship programmes, for example. The research field itself could potentially be drawn upon to support and, in particular, to evaluate transfer and science communication activities, such as providing scientifically sound guidance for relevant projects, initiatives or programmes. This applies particularly in the case of providing evidence-based advice for political or social activities. It also requires communication about research findings with stakeholders from science management, science policy and research funding bodies.

- **Effective integration of theory and practice:** Above and beyond mutual inclusion and joint networking, we need to maintain the close interrelationship between theory and practice in science communication (within both research and teaching). We must avoid developing silo mentalities or diverging into "professional", supposedly non-scientific science communication practice and non-practical science communication theory; experience has shown that this leads

to negative duplications and to lower quality overall, in both practice and research. Conducting research into practical issues of science communication, and interpreting and pooling this for key stakeholders in an accessible manner (e.g. in customised “Science Briefs”) can constitute an important route to achieving this, for scientists, science-related or science-supporting staff as well as for other professional groupings or sections of the public with a direct interest in science communication (for example science journalists or directors of exhibitions). To facilitate this interaction, it is important to promote joint learning and discussion forums for researchers and practitioners, such as in the context of appropriate online platforms, blogs, meeting spaces or co-working venues or integrated research and working groups. The establishment of this research field as a foundation for scientific and professional teaching and training provision, as set out above, will also contribute to greater integration whilst promoting the professionalisation of the professional and research field of science communication. This will require support for appropriate institutional framework conditions as well as for the collection and curation of suitable teaching materials and the certification of continuing education courses (and recognition of these for professional development). In turn, knowledge transfer from science communication research into practice and training should itself be systematically evaluated. Support structures for the integration of science and practice include both the establishment of institutions for science communication research as discussed above (e.g. within universities, research organisations, academies) and also combined institutions for the development of competence (e.g. Berlin School of Public Engagement and Open Science) as well as networking institutions and intermediaries (e.g. Berlin University Alliance, Wissenschaft im Dialog).



Action area	Objectives	Measures
Capacity building	High-quality inter- and transdisciplinary research	Initiation of a long-term framework programme for inter- and transdisciplinary science communication research
		Development of institutional and staff capacity for science communication research (e.g. by creating chairs and founding centres)
		Support for accompanying research into the conditions for success for science communication
		Support for a continuous representative survey of science-related beliefs and trust in science e.g. by expanding "Wissenschaftsbarometer" and continuing this on an ongoing basis
	Networking of the research field	Initiation of interdisciplinary networks and working groups
		Strengthening of dialogue between relevant specialist societies through the organisation of specialist conferences and workshops
		Founding of an interdisciplinary society for communication research
	Strengthening of international and European collaboration	Intensification of internationally comparative research
		Development of international/European forums for scientific discussion
		Founding of a European specialist journal
Support for early-career researchers	Training opportunities for new scientists	Establishment of modules and course specialisms
		Establishment of master's courses
		Development of (transdisciplinary) graduate programmes

Action area	Objectives	Measures
Communication of own knowledge	Quality assurance in science communication	Applied research and reflection on structural issues related to quality assurance, reputation mechanisms, impact expectations
		Inclusion of the research field in evaluations of transfer and science communication activities
		Support for evidence-based political and social advisory activity
	Exchange between theory and practice/ evidence-based science communication	Systematic development of synopses and meta-research relating to practical issues and presentation to key stakeholders within science communication
		Expansion of joint learning and discussion forums for scientists and practitioners
		Establishment of the research field as the foundation for teaching and training provision for doctoral students and staff development (see chapter on “Science Communication Competence Development”)
		Support for evidence-based political and social advisory activity

QUALITY

IN SCIENCE COMMUNICATION

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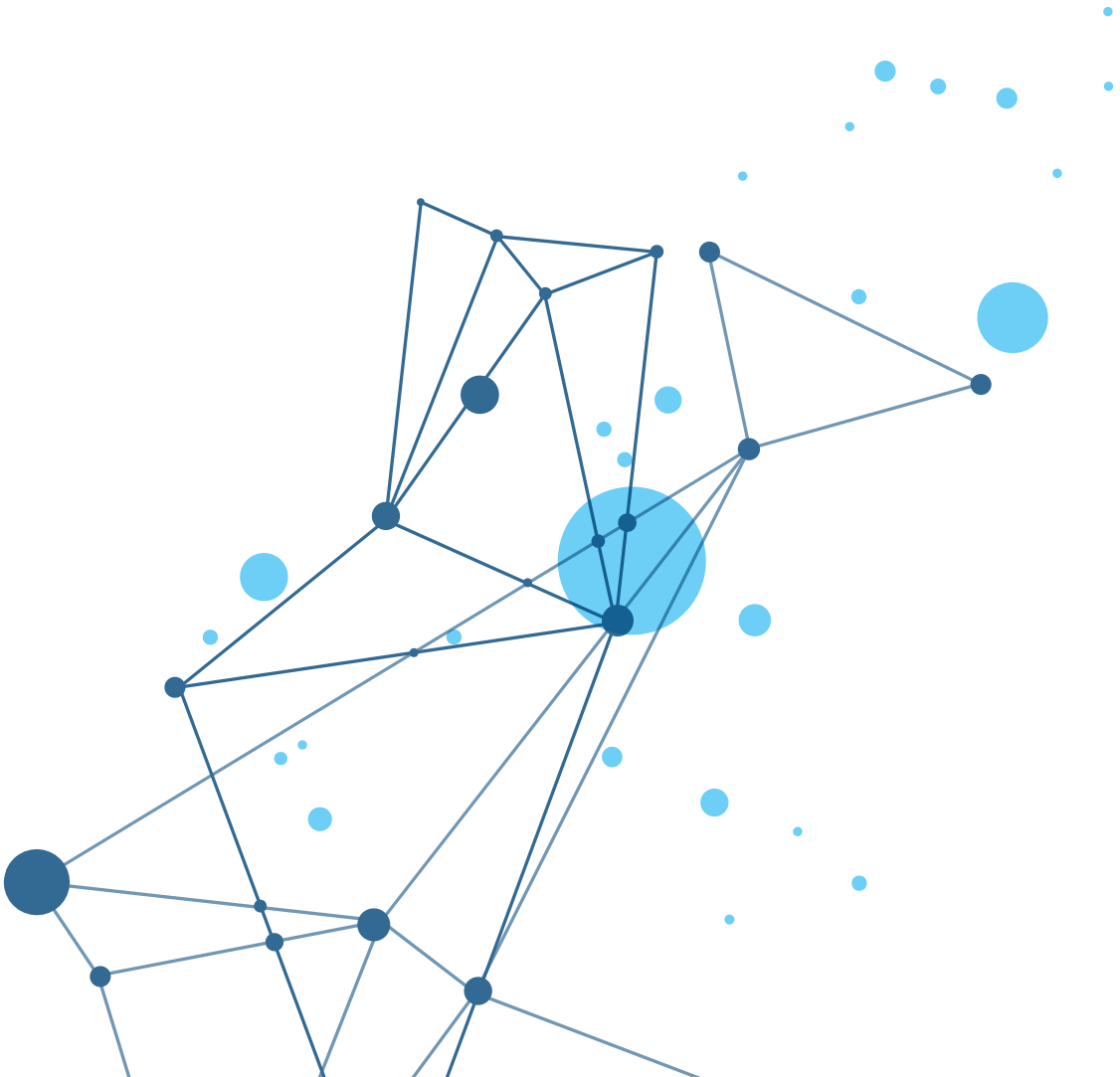
As part of #FactoryWisskomm, this working group has focused on current developments and challenges in the areas of quality and impact assessment in science communication. The following analyses, objectives and recommendations for action have been developed on the basis of their brief and on preliminary work undertaken at the #FactoryWisskomm launch event in September 2020.

Overview

Over the past 20 years, and in particular in the wake of the PUSH initiative by the major scientific institutions, there has been a significant increase in the number and scope of formats for science communication in Germany. In parallel with the objective of ensuring good scientific practice, a central aim of stakeholders in the field of science communication is to ensure good science communication. Science communication is moreover perceived by the public as embodying high quality standards both in terms of the processes and findings being communicated and in terms of the communication formats themselves. Science communication thereby upholds and promotes public trust in science and consequently prevents hostility towards researchers. Scientific organisations and institutions have already laid the foundations for quality assurance in science communication. This chapter addresses the question of how these can be improved even further.



Starting point

Different position statements and guidelines relating to **quality** have already been published by a range of bodies and institutions, with varying degrees of specificity. These include the statements by the academies on the relationship between science – public – media,[2] the positioning paper by the Wissenschaftsrat [German Council of Science and Humanities] on knowledge and technology transfer[3] and on the COVID-19 pandemic,[4] the ten-point plan by the Alliance of Science Organisations in Germany,[5] the "Guidelines for good science PR"[6] and the "Guideline evidence-based health information" [sic].[7]

To date, there have only been limited attempts to develop the existing guidelines further to take account of lessons learned from crisis communication during the COVID-19 pandemic. The process of establishing guidelines within the context of the differing structures and processes of the science system has also not yet been fully achieved.

The principles of good scientific practice,[8] together with the existing guidelines and agreements, already offer a foundation for implementing quality assurance in science communication. Criteria derived from these, to which good science communication adheres, include for example:

- Application of the principles of good scientific practice
- Trustworthiness, integrity, independence
- Transparency regarding intentions and conflicts of interest
- Benefits for science and society
- Comprehensibility for society
- Openness to active dialogue with society

The central challenge consists in promoting overarching dialogue between all the different stakeholders within science communication (institutions of higher education, non-university research institutes, specialist associations, journalists including decision-makers) about values and principles, in order to then devise and propose guidelines for quality management. A key area that can support quality development in science communication is **impact research** (as a subfield of science communication research). It can and should provide important impetus for science communication.

2 Nationale Akademie der Wissenschaften Leopoldina, Deutsche Akademie der Technikwissenschaften – acatech, Union der deutschen Akademien der Wissenschaften (2014).

3 Wissenschaftsrat (2016).

4 Wissenschaftsrat (2021).

5 Allianz der Wissenschaftsorganisationen (2020).

6 Bundesverband Hochschulkommunikation, Wissenschaft im Dialog (2016).

7 Lühnen J, Albrecht M, Mühlhauser I, Steckelberg A (2017).

8 Deutsche Forschungsgemeinschaft (2018).

Vision and objectives

In order to achieve this objective, the stakeholders decide on shared **values, principles and guidelines for science communication**, within a suitable framework. These agreements should be regularly updated to reflect new developments and challenges.

Guidance regarding actions can support communicators and scientists in implementing the guidelines. This includes evidence-based criteria for high-quality science communication.

Closely interlinked with quality assurance, **impact research** provides support for the development, implementation and prioritisation of science communication activities. This requires dialogue and **transfer** in both directions. To this end, science communication and impact research must focus more strongly on the perspective of the audience and take into account the lived experience of the respective target groups. The long-term impact and unexpected consequences of science communication should therefore become an object of consideration. At the same time, impact research also serves to formulate the foundations of knowledge, on the basis of empirical evidence.

Recommendations for action

Agreement on shared values and principles from which guidelines regarding quality assurance in science communication are derived

On the basis of the values and principles described above, and of existing guidelines, position statements and agreements (e.g. position statements on science, the public and the media by the academies, "Guidelines for good science PR"), the members of the Alliance of Science Organisations in Germany, in conjunction with the Bundesverband Hochschulkommunikation and Wissenschaft im Dialog, should develop guidelines for quality assurance in science communication. These guidelines can serve as a basic list for orientation purposes, and can be used by institutions according to their specific situations. They will be made readily accessible.

Integration of the guidelines for good science communication into the guidelines for ensuring good scientific practice

This integration means that the guidelines for good science communication will become an element of the existing and well-established regulatory framework.

Support for implementing quality assurance in science communication

Scientific institutions would be well-advised to develop their own recommendations for implementing quality assurance, building on the guidelines and criteria for good science communication. They can base these on existing guidance, for example the quality initiative by the Bundesverband für Hochschulkommunikation. This is the most effective way to take account of the differing framework conditions for science communication in different locations and within different disciplines, as well as any barriers to implementation – inadequate structures, incomplete information, insufficient resources.

Establishment of a constructive error culture/ protection of researchers

A panel consisting of representatives from all areas of science communication should be created to advise regularly on current developments and challenges within the field. It could offer online surgeries to provide advice on specific issues to communicators and scientists (e.g. on working with the media or on political issues). Furthermore, ombudsmen or persons of trust within institutions could contribute to the establishment of a constructive culture of errors. They could provide advice and support in difficult situations, thereby contributing to quality assurance. Existing structures should be utilised for this purpose.

Creation of incentive structures for the establishment of framework conditions, capacities and competences to assure quality in local contexts

Incentives to embed considerations of quality assurance within the work of institutions or at local/regional level can be offered via funding guidelines or competitions, e.g. held by the Federal Ministry of Education and Research. Intelligently designed competitions can often succeed in bringing about structural change and thus in having a long-term effect. It might also be possible to incorporate the reinforcement of quality assurance within the structure of a larger competition. Key criteria should be: development of own quality principles by the institutions; nomination of permanent contacts and creation of a plan for acquiring and maintaining competence in this area.

Further development of regular discussion between different stakeholders on objectives, methods and findings.

Low-pressure situations could be used for this purpose, such as a regular online discussion group or existing platforms for discussion such as www.wissenschafts-kommunikation.de or specialist symposia, such as the "Forum Wissenschaftskommunikation" conference, the "WissKon" conference, the "Allianz-Arbeitskreis Wissenschaftskommunikation" or the conference held by the Bundesverband Hochschulkommunikation.

Strengthening research into science communication

As an element of science communication research, impact research can supply important inspiration for practice. A specialised science communication society should therefore be founded to support it (see chapter on "Science Communication as a Field of Research"). This could then compile and structure findings from scientific impact research on behalf of those engaged in practice. In this way, we could seek to achieve consensus on the continuum which ranges from impact measurement by means of evaluation (by practitioners), to accompanying research (in collaboration with scientific researchers), to foundational research on impact assessment (by researchers).

SCIENCE COMMUNICATION AND

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Overview

Key messages

- Our vision is that participatory science communication should be conceived of as a strategy, with its own objectives, methods and formats. The value which it adds should be transparent and comprehensible for all involved: participatory science communication is not an end in itself. Rather, we should continuously explore, reflect upon and creatively develop the potential offered by participation.

- We believe that formats that transmit or inform will continue to be essential elements of science communication and will form the foundation for participatory initiatives. However, they alone are not sufficient for shaping a science- and values-based debate within society on scientific content, processes and framework conditions.

- In parallel with participatory approaches to science communication, a variety of concepts have been elaborated for participation in the fields of research and innovation. Despite their sometimes varied manifestations, three basic forms of participation in science and/or science communication may be distinguished:

  1. Participation in relation to research objectives, agenda, governance, framework conditions (e.g. dialogue with citizens, consensus conferences, consultations, involvement of stakeholders in relevant committees)

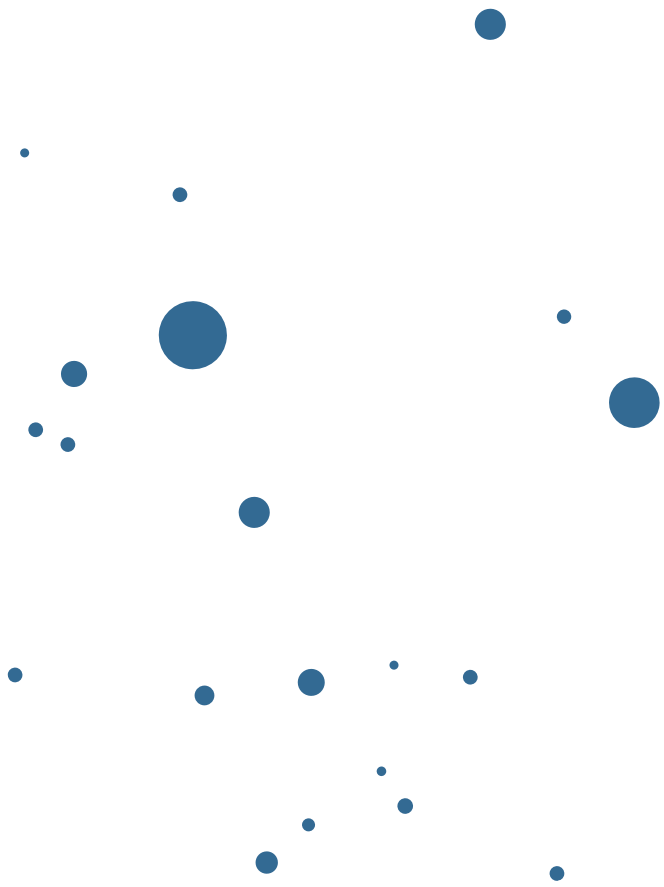
  2. Participation in the form of direct involvement in research (e.g. citizen science, open science)

  3. Participation in the sense of experiencing, joining in, taking part in debate as a mutual learning experience for all those involved (e.g. in science centres, hands-on learning sessions for schools)

- Participatory science communication is especially important when it is anticipated that the inclusion of other stakeholders – and their knowledge, experience and expertise – will render processes and results more socially robust. This means that the social context is then considered even at the stage of knowledge production, and other bodies of knowledge, e.g. everyday knowledge, are therefore also included.

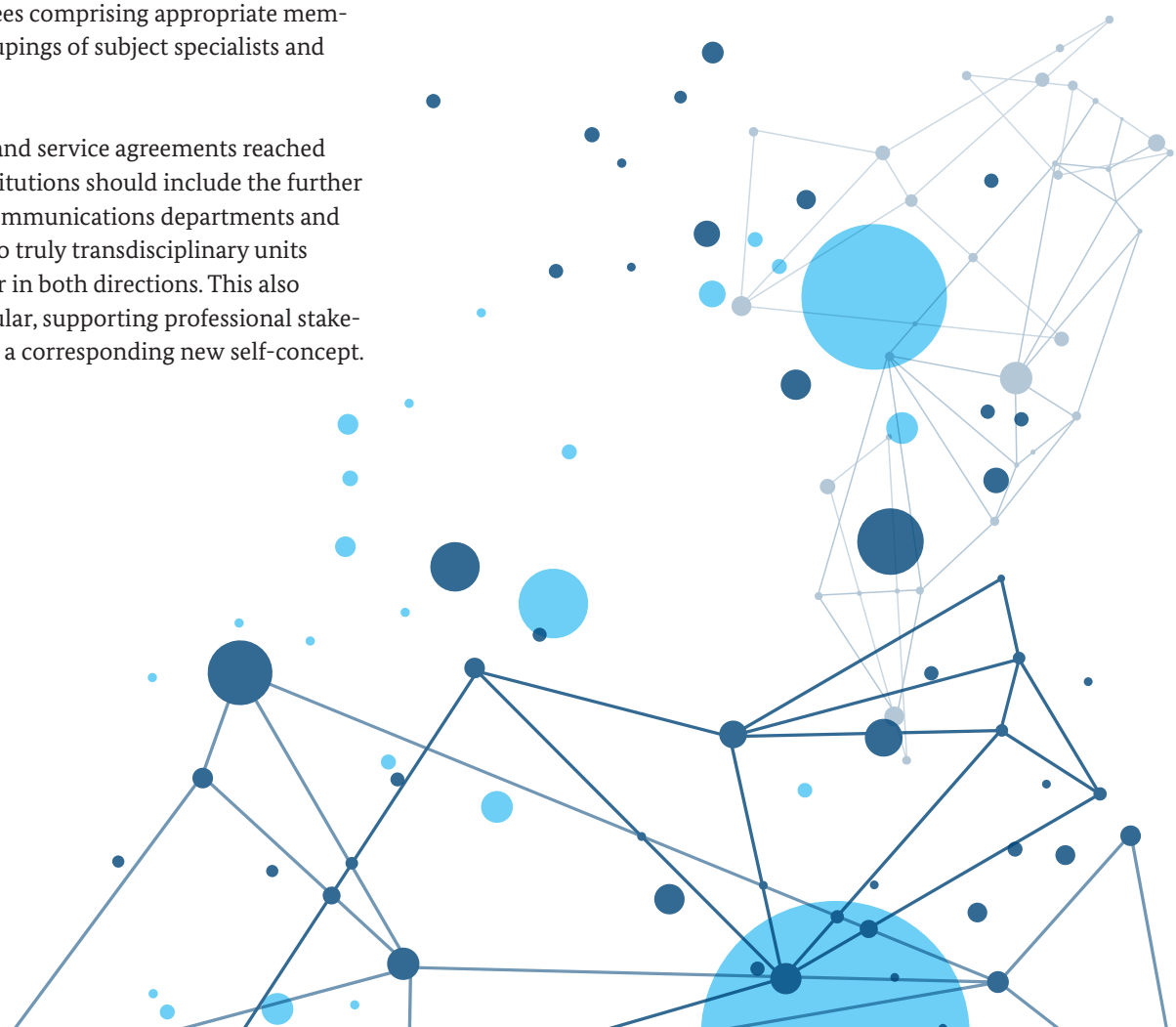
- If participatory science communication is to honour the democratic requirement for opportunities to become involved, then invitations and options must be sufficiently diverse to elicit the broadest possible response and to facilitate the participation of all social and cultural groups.

- We should also rethink the directionality of participatory science communication. All too often, it is designed as a top-down process emanating from science and/or politics. Bottom-up suggestions and expressions of interest in participation originating from within society should equally be considered.



Measures

- The science system should – with the support of politics – initiate and promote a cultural shift towards science communication in which participatory formats – known as public engagement – play a key role alongside informational approaches. Long-term funding lines are required for this purpose, together with appropriate change processes and further professionalisation of participatory science communication.
- In future, the funding required for this purpose should form an element of core finance and should accordingly be set out in scientific institutions' performance and service agreements.
- Particular support should be provided for formats that purposely include people from every social and cultural background and enable them to share in the design of formats and to draw benefit from their involvement themselves.
- The recognition of social expertise is manifested in advisory committees comprising appropriate members as well as groupings of subject specialists and experts.
- The performance and service agreements reached with scientific institutions should include the further development of communications departments and transfer offices into truly transdisciplinary units facilitating transfer in both directions. This also includes, in particular, supporting professional stakeholders to develop a corresponding new self-concept.
- Scientific institutions should create interfaces for experimentation and dialogue for the purpose of participatory science communication. This should be understood as a reflexive process that creates space and is designed for open outcomes.
- On the one hand, we need to strengthen existing meeting spaces such as, for example, museums or public science forums. On the other, we should also develop new interfaces – such as e.g. citizen science academies or commercially oriented open innovation initiatives.
- Over the long term, a joint interdisciplinary learning network for participatory science communication should be established for the purpose of interaction between scientific institutions, intermediaries, places of learning other than schools and other stakeholders.



Starting point

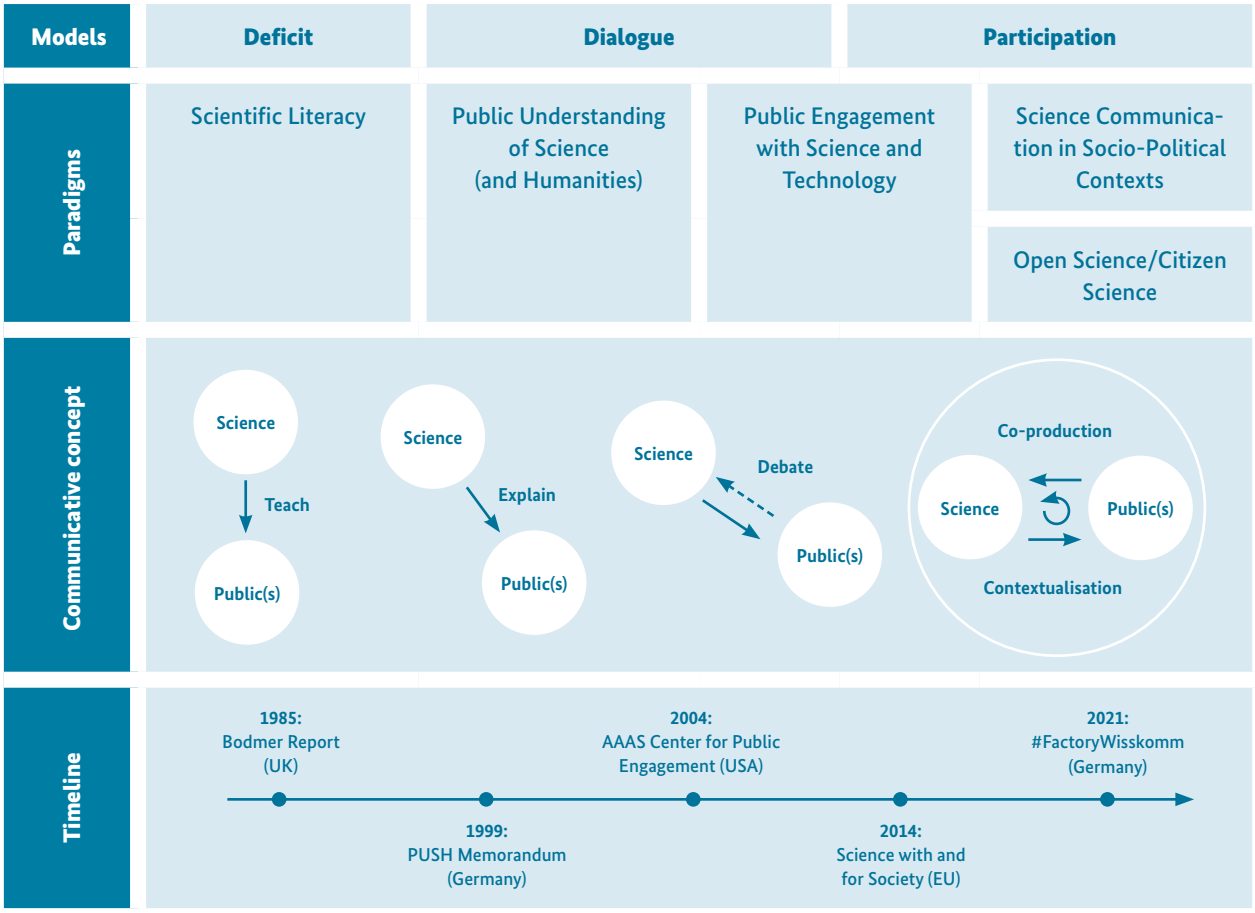
The importance of participatory science communication – paradigm shift in science communication

In recent decades, the spectrum of science communication has been extended from purely informational activities of knowledge transmission to include more interactive and participatory formats. This trend takes into account the fundamental orientation of science towards public service and simultaneously corresponds with the growing need of citizens to be involved in scientific and technological developments with ever greater social impact.

Science communication that focuses on participation, and social participation in the scientific process are thereby important expressions of democratic participation.

The so-called "Deficit Model" starts from the assumption that information is transmitted in one direction (from "Science" to "Society"); it is in this way that acceptance of the content transmitted is generated. This stands in contrast to the model of participatory communication, which has long been considered the paradigm of contemporary science communication, especially in English-speaking countries.

Paradigm shift in the conceptualisation of science communication



We believe that science communication formats that transmit or inform will certainly continue to be essential elements of science communication and will form the foundation for participatory initiatives – but that they alone are not sufficient to provide the preconditions for shaping a science- and values-based debate within society on scientific content, processes and framework conditions.

In the German-speaking countries in particular, the importance of modern, participatory science communication formats is still commonly underestimated. The "Deficit Model", which has predominated to date and which is exclusively focused on the transmission of information in one direction only, continues to represent the cornerstone of many stakeholders' conceptualisation of science and communication.

Participatory science communication

Participatory science communication is especially important when it is anticipated that the inclusion of other stakeholders – and their knowledge, experience and expertise – will render processes and results more socially robust (i.e. for the social context to be considered even at the stage of knowledge production, and other bodies of knowledge, e.g. everyday knowledge, to be included).

Of course, participatory science communication, just like any other form of responsible science communication, respects the freedom of science and research and is committed to the principles of good scientific practice.

Participation in research, political participation and science communication

Parallel to these developments in the conceptualisation of science communication, numerous initiatives and theoretical concepts have been devised within science for participatory approaches to research and innovation, for example "Mode 2" and "Mode 3" research, post-normal science, the quintuple helix model, "Responsible Research and Innovation" and the third mission. In the course of the digital transformation, new forms and opportunities for communication and collaboration are also emerging, breaking down the social distance between science and the public. Various science-related formats and approaches from the field of political participation go back further, for example participatory technology assessment.

Despite their multiplicity and their sometimes varied manifestations, three basic forms of participation in science may be distinguished:

1. Participation in relation to research objectives, agenda, governance, framework conditions (e.g. dialogue with citizens, consensus conferences, consultations, involvement of stakeholders in relevant committees)

2. Participation in the form of direct involvement in research (e.g. citizen science, open science)

3. Participation in the sense of experiencing, joining in, taking part in debate as a mutual learning experience for all those involved (e.g. in science centres, hands-on learning sessions for schools)

In practice, these forms may overlap or supplement each other, for example in the case of dialogues with citizens or in citizen science projects, which may equally incorporate individual learning experiences or political demands derived from the findings of citizen research projects, e.g. in relation to environmental protection measures.

Furthermore, we can observe an increasing blurring of boundaries between internal and external science communication, driven by digitalisation in particular. Scientific projects and findings are already picked up at an early stage by general social and political discourse (as was evident, for example, in the discussion of preprints that had not yet been peer-reviewed as a basis for political decision-making during the current COVID-19 pandemic); they are not simply reported to the public once they are already "downstream" (mediatisation). Open science as a new paradigm for science unites many forms of openness, participation and communication. The field of citizen science also includes an important science communication element, alongside its core of scientific work with citizens.

Where we consider the greatest challenges to lie

We have identified the following challenges in the area of participatory science communication:

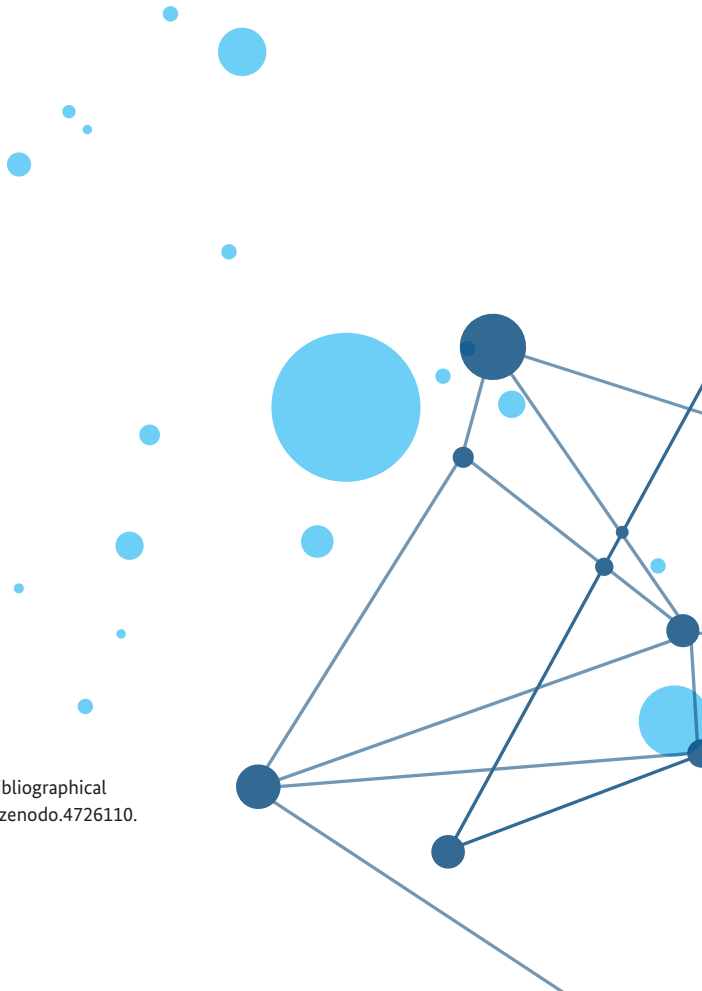
- If participatory science communication is to honour the democratic requirement for opportunities to become involved, then invitations and options need to be sufficiently diverse to elicit the broadest possible response. Previous provision – even if designed to be participatory – has mostly reached only a small proportion of the population. Even if individual formats do not or cannot themselves reach everyone, the following questions still apply: How can we consider and include people who have not yet been reached? How can we achieve participation by as many social and cultural groups as possible?

- We should also rethink the directionality of participatory science communication. All too often, it is designed as an exclusively top-down process emanating from science and/or politics. How can bottom-up suggestions and expressions of interest in participation originating from within society, rather than initiated by science, be taken into account (so-called "unsolicited participation")?

- Systemic obstacles within the science system, such as e.g. pressure to publish, lack of recognition or insufficient incentives, prevent or hinder participatory science communication. In Germany, involvement in science communication is still considered an impediment to researchers' careers, rather than a requisite skill. How can we persuade the relevant decision-makers to remove these obstacles? (See "Reputation and Recognition of Science Communication".)

- Whilst so-called "asymmetries of knowledge" are often perceived by traditional science communication as a barrier to debate, participatory science communication exploits these as the productive starting point for dialogue and engagement on an equal footing. Nevertheless, the question arises as to whether and where limits exist to openness in science and/or participation: on the one hand, with regard to conflicts of interest between different stakeholders or social groups that cannot be resolved through compromise, and, on the other, in relation to the denial of evidence-based statements.

- Many scientists and political decision-makers have only a limited understanding of the variety of transmission methods employed by participatory science communication. How can we succeed in conveying existing educational and social-scientific knowledge relating to participation and science communication more comprehensively, and ensure it is given greater consideration in practice? (See "Science Communication Competence Development" and "Science Communication as a Field of Research".)[9]



9 An extended version of this chapter, including supplementary material and bibliographical references, is available as a discussion paper online: https://doi.org/10.5281/zenodo.4726110.

Recommendations for action

Our overarching vision for the action area

We understand participatory science communication as a diverse, continuously developing element of modern science communication:

- It picks up on the various existing traditions of participation in science and science communication, which are tied to specific disciplines and have a particular focus (e.g. action research, transdisciplinary/transformative sustainability research, participatory technology assessment, citizen science), and promotes mutual exchange between communities of researchers and practitioners who have previously often worked in isolation from each other and other groups within society.

- Participatory science communication is envisioned as a strategy, with its own objectives, methods and formats. The respective added value of participatory projects for all those involved is transparent and comprehensible: participatory science communication is not an end in itself. Rather, we should continuously explore, reflect upon and creatively develop the potential offered by participation.

- Last but not least, participatory science communication makes an essential contribution to the development of democracy, since, on the one hand, it promotes mutual recognition of needs and thought processes, and therefore over the longer term also promotes mutual understanding. On the other hand, successful participation by citizens, in the sense of engagement in shared scientific endeavour, can promote their sense of self-efficacy and thereby also their interest in democratic participation more generally.

- In particular, we can facilitate extremely diverse forms of participation by differentiating and further developing digital formats – insofar as these formats are suitably designed and inclusively implemented. The COVID-19 pandemic has necessarily pushed science communication abruptly in the direction of digitalisation. Even if not everything was successful, we can now build on the positive examples and learning experiences and take our thinking about digital participatory science communication to the next level.

In the science system, we need a cultural shift towards science communication in which participatory formats play a central role alongside informational formats:

- By engaging in science communication that has been designed to be participatory and that includes all sections of society, science can derive new inspiration for its own research, as well as a better understanding of social attitudes and needs. Participatory science communication integrates relevant system knowledge (on the actual state), target knowledge (on the target state) and transformation knowledge into research processes. It thereby achieves increased acceptance of scientific processes and findings, and ultimately also ensures increased public visibility of science careers.

- Scientific institutions develop and promote new role models and self-conception for science communicators as intermediaries between science and civil society, who work in both directions.

Political system and administration: participation as a contribution to the development of democracy

Political officials should recognise that science communication that focuses exclusively on conveying scientific findings and processes “from science to the citizens” is no longer sufficient in the face of the challenges posed by major social transformations. They should utilise appropriate funding instruments to support the establishment of approaches to science communication that are aligned with the principles of dialogue and participation.

Consolidate participation as a guiding principle of science communication

Science communication that focuses on participation, and social participation in the scientific process itself are both important expressions of democratic participation. Therefore, political decisions concerning funding and organisation of science communication, and corresponding administrative processes, should in future be based on the guiding principle of participation. This is apparent from the relevant policy documents, announcements and invitations to tender.

We should be in no doubt that there exists a wide variety of traditions and different understandings of the concept of participation. Therefore, those involved in politics in particular need to clarify the potential and appropriate scope of each respective participatory process. Political and administrative officials recognise that participatory processes have fundamentally open outcomes, and do not view them as merely instruments for the generation of acceptance. During the implementation of participatory processes, politics demands appropriate transparency and commitments from all stakeholders, and also commits itself to these.

Recognise and utilise the expertise of citizens and civil society

Political and administrative officials should act with the conviction that social challenges can only be tackled through the interplay of scientific and (civil) social expertise. The recognition of social expertise should be manifested in advisory committees comprising appropriate members as well as in groupings of specialists and experts. This takes account of the fact that relevant knowledge is also available outside institutionalised science, and also constitutes a practical expression of the belief that recognising and utilising the knowledge possessed by civil society will ultimately also benefit the quality of science itself. Political and administrative officials should ensure that representatives of diverse groups within civil society are always included in advisory committees (research councils, innovation dialogues, etc.), and should seek to involve suitable participants. The selection criteria for, and composition of, committees should be transparent and accessible.

Promote cultural change

The science system should – with the support of politics – initiate and promote a cultural shift towards science communication in which participatory formats – known as public engagement – play a key role alongside informative approaches. Expanding appropriate programmes and continuing these on a permanent basis is of fundamental importance in this respect: examples include the current Federal Ministry of Education and Research current programme “Innovative Analogue and Digital Participation Formats” and the funding guidance for the participatory Science Year 2022. Programmes of this type should support short-, medium- and long-term projects in establishing participatory science communication.

Formats that consciously and effectively address people from every social and cultural background are especially deserving of support. This does not imply simply addressing a broad range of potential participants, but also arranging the framework conditions in such a way that everyone has an equal chance of becoming involved (e.g. by reimbursing expenses or holding events at different times of day). The potential for communication and interaction offered by digitalisation should be deliberately exploited for this purpose. Moreover, consideration should always be given to the question of groups which have not been reached, and this issue should be addressed in evaluations and reports.

In addition to strengthening departments of science communication, the development of transfer offices into truly transdisciplinary units ensuring transfer in both directions should be included as an objective in the relevant performance and service agreements with scientific institutions. This should make a particular contribution to the transfer of social issues and problematics into the science system and serve as an interface with bottom-up initiatives from civil society. In line with the growing significance of the “third mission” within higher education institutions, transfer is here explicitly understood to no longer imply simply technology transfer, but rather to encompass interaction with civil society, culture, business and politics. In the interest of opening up research processes, we therefore need to support the establishment of appropriate, low-threshold meeting spaces via suitable measures and programmes.

Institutionalise participation formats

Participation formats should be standardised, especially in controversial fields of technology and research. Politics can and should establish the framework conditions for this, for example by embedding the establishment of suitable advisory committees composed of members of civil society in their performance agreements with the scientific institutions and by making a financial contribution to the requisite infrastructure. Corresponding formats should also be integrated into the training of new scientists.

Secure structures financially

Establishing participatory science communication at institutions of higher education and research institutes is a demanding undertaking and requires adequate financial support. In future, this should form an element of core finance. This is the only way to ensure the necessary scope to also be able to respond to the requirements of bottom-up initiatives originating in civil society.

Science system: participatory science communication becomes an element of good scientific practice

To ensure a future-oriented science system, both informative and participatory science communication should be implemented as expected elements of good scientific practice. For this purpose, measures should be undertaken at individual, institutional, methodological and systemic levels.

Professionalisation and institutionalisation

Students of all subjects should – even at foundation level, if possible – be introduced at an appropriate point (e.g. during introductory sessions on scientific theory) to the principles, potential applications, strengths and challenges of both informative and participatory science communication. Students should furthermore be offered the opportunity to participate in science communication projects at an early stage in their training and become familiar with a variety of practical formats and concepts (e.g. work with children's universities, outreach projects, open days or citizen science projects).

Proposals for scientists to devote a specific proportion of their working hours to dialogic science communication in future (for example, "one day per week in dialogue with society") should be seriously examined, trialled in pilot studies and, if these prove favourable, translated into permanent models with broad application.

Institutions should create interfaces for experimentation and dialogue for the purpose of participatory science communication. Participatory science communication should thereby be understood as a reflexive process that generates space for creative responses and is designed for open outcomes. The spaces for reflection that it opens up serve to support communication within institutions and permit productive engagement with anxieties, barriers and restrictions.

In the medium term, we should aim to establish competence centres for participatory science communication within institutions (e.g. by converting press and public relations offices at universities into competence centres for participatory science communication, which will also integrate the existing transfer units).

Over the longer term, we should seek to establish a joint transdisciplinary learning network for participatory science communication which brings together scientific institutions and intermediaries (such as places of learning other than schools, the communications departments of higher education institutions, research institutes on science of science communication and museums).

Appreciation, resources and success criteria

The fundamental obligation and responsibility to engage in participatory science communication lies with institutions; it should not be shifted to individual staff members. However, institutions should support staff engagement and involvement by providing resources and developing structures of recognition (see "Reputation and Recognition of Science Communication".) The higher costs involved in actively addressing and involving groups within the population who have not been reached by previous formats should be factored into resource planning. In addition to quantitative measurements of reach, additional success criteria should be defined depending on the project (e.g. quality or sustained impact of the interaction).

Development of methodological diversity

Researchers and lecturers at scientific institutions should be encouraged to discover the potential applications as well as the limits of participatory science communication in practice. For this purpose, scientific institutions should facilitate their participation in tailor-made skills training and support sessions on formats and methods of (participatory) science communication.

They should encourage dialogue and interaction between researchers and lecturers from different subject specialisms in learning communities. A precondition for this is that knowledge (methods, organisation, logistics and didactics) relating to participatory science communication should be systematically acquired and made available in an institutional setting.

Reflect on potential and limits

In the course of the cultural shift towards a participatory approach to science communication, the fundamental values of science, such as freedom and objectivity, should continue to be assured. All stakeholders involved shall engage in reflection on the potential and also the limits of participation. In the case of participatory decision-making processes in particular, the implications of, and obligation imposed by, co-determination should be weighed up against the autonomy of science in each individual instance.

Intermediary institutions and civil society: establishing spaces for exploration and dialogue

Successful participatory science communication is increasingly being undertaken by an ever more diverse range of intermediaries. The traditional intermediary for science communication is science journalism. We can also count those engaged in social media activities as intermediaries. However, many other institutions and stakeholders within science and civil society, as well as "third places" such as museums or science centres, are also playing an important and growing role.

A decisive factor in widening citizen participation is the inclusion of these intermediaries in participatory science communication alongside civil society itself. For this purpose, it is important to continue to develop appropriate methodologies, create educational provision, support intermediaries in a systematic manner and, linked with this, to modify funding guidelines. We would also recommend that consideration is given to incentive systems for citizens, in order to achieve the widest possible participation by citizens from all social and cultural backgrounds.

Establishing and strengthening intermediary sites

It would be desirable on the one hand to strengthen existing meeting spaces, such as the Leibniz research museums, the Futurium, public science forums, science shops, museums devoted to natural history or the humanities and learning laboratories. On the other hand, the development of new contact points or interfaces with the research and innovation system is an important area of action. New intermediary sites might include e.g. citizens' science academies, advisory boards composed of members of civil society, scientifically oriented open innovation initiatives, as well communities with a participatory approach.

Establishing and reinforcing spaces for exploration and dialogue is becoming increasingly important for the ability to respond in an agile manner to social demands (both in the case of large-scale processes of transformation and limited local challenges). They make it possible for science and civil society to elaborate joint strategies to address relevant issues and to discuss plans for the future.

Journalism as the traditional intermediary

Science journalism plays a key role as an intermediary, alongside stakeholders within science communication. Despite their clearly distinct roles and remits, the spectrum of objectives for each group demonstrates overlap: the task of making science accessible, their engagement in critical coverage of, and reflection on, scientific processes and findings, and their integration of the perspectives of science and civil society and other frames of reference into a single discourse. These similarities mean that many touchpoints can be identified for potential future collaborations. Examples of this might include citizen science journalism, greater inclusion of participatory processes and findings in the work of science journalists, or conversely, the inclusion of science journalists in shaping participatory processes (see "Science Journalism in the Digital Era").

Further development and funding

Training provision should be established for all stakeholders in the knowledge production process, precisely in order to address those questions that appear simple but are actually difficult to answer: When is an informative format appropriate? When should participatory formats be used? How do I implement participatory science communication as a scientist? How do I get involved in a research topic as a citizen? How can I translate a practical problem into a scientific question?

Co-creation and co-design processes should become institutionalised to such an extent that participation in the implementation of co-creative methodologies is recognised and valued (e.g. through consideration in the patent process and in commercial exploitation, or through co-author status for participants) and participants are also embedded in the subsequent innovation processes.

Funding organisations should ensure that participatory science communication is included as a component of funding programmes. These organisations in turn should serve as hubs, advising on, developing and implementing appropriate formats and programmes.

SCIENCE JOURNALISM

IN THE DIGITAL ERA

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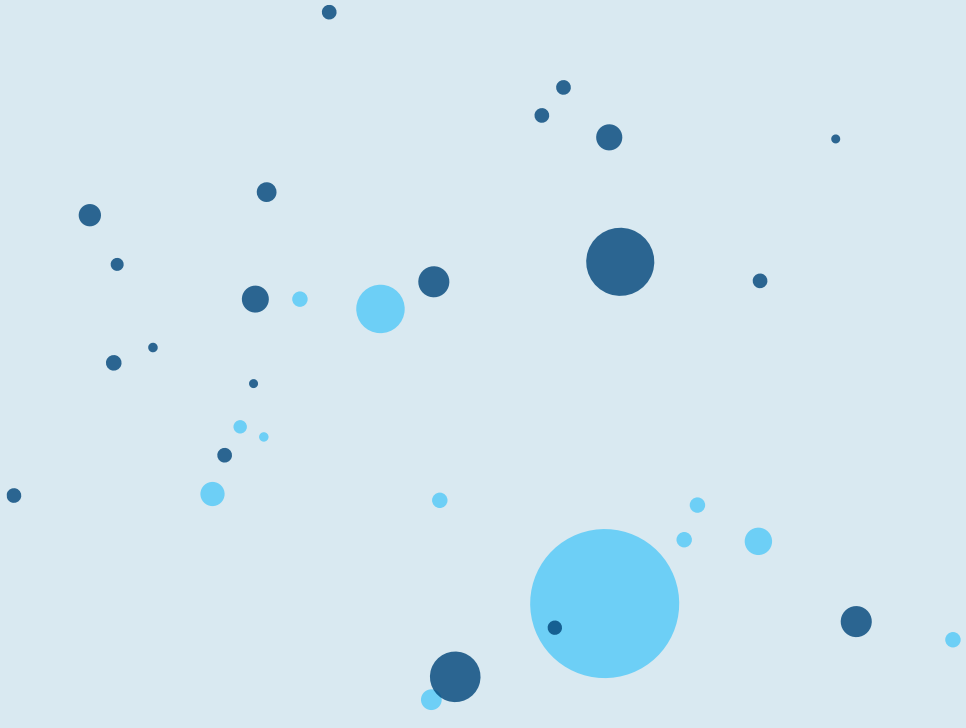


Overview

Science journalism – in the sense of quality journalism about the full spectrum of science – is of key importance for the formation of knowledge and opinion in a democracy. Science journalism helps society to comprehend, evaluate and take account of scientific developments. It acts as a competent and independent external observer of science, with an awareness of social expectations. It would be impossible for these tasks to be fulfilled by well-meaning or high-quality communications originating from within science itself: these cannot not serve to replace the perspective of an external observer.

At the same time, journalism itself is in the midst of a digital transformation that is eroding journalistic business models and endangering the discourse-ordering function of the profession. Collaboration and support – including financial support – are needed to ensure that science journalism emerges from the digital transformation in a stronger position.

The provision of support for innovative and digital journalism about science could serve as a pilot project for other areas of journalism of direct public benefit as well. The working group has defined appropriate measures to secure and strengthen science journalism, identified stakeholders and formulated participation options for #FactoryWisskomm stakeholders. We have summarised these below in the form of key points, before going into greater detail in the paper that follows.

Research and innovation policy

- Competitive funding programmes should promote innovation and collaboration in science journalism, and dialogue platforms should support practical transfer.
- A "Science Center for Computational Journalism" (in the form of an affiliated institute) should develop data journalism services.
- The digital transformation of science journalism should be supported by intensified research into this journalistic field. Particularly important topics are suggested below.

Competence development and support for early-career journalists

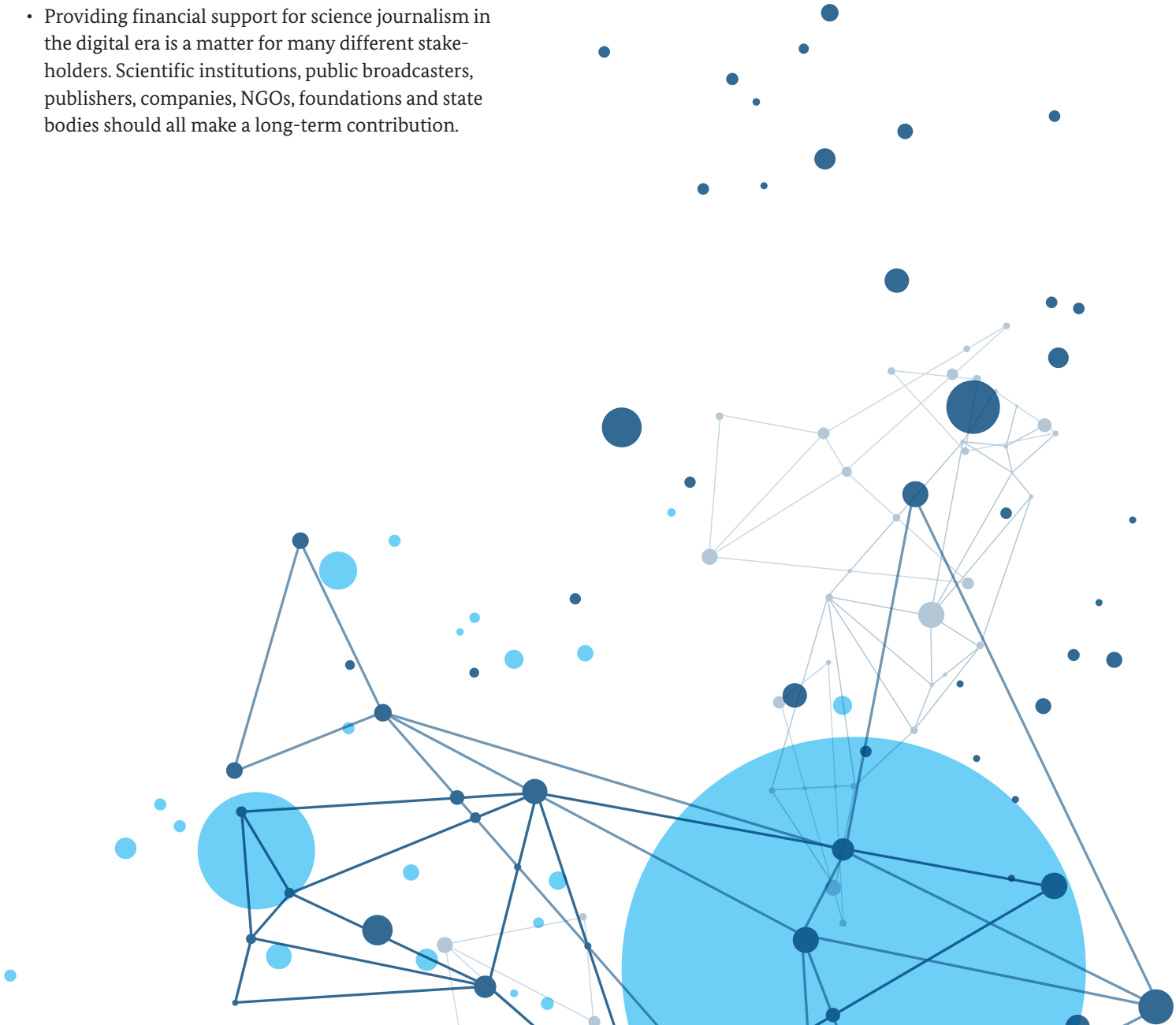
- A redesigned mentoring programme for science journalism, in conjunction with partners from science and the media, could help to open up career paths in science journalism and could be complemented by programmes to fund residencies by journalists at scientific institutions.
- A training academy will make digital innovation more accessible to science journalists.
- Science journalism, media competence and innovation all have a place in the curriculum.
- Funded traineeships for postdocs could help to smooth the transition between science and journalism and keep career options open for longer.

Intermediaries and funding structures

- Intermediaries such as the Science Media Center Germany should be bolstered and further developed; institutions such as the state media institutes should be encouraged to offer more provision for/with science journalists.
- A RegioScienceDesk could be founded to produce quality science journalism on behalf of local/regional newspapers.
- A funding structure (such as a German "Verbrauchsstiftung" or spend-down foundation) governed by journalists should ensure that funding is allocated sustainably and independently.

Systemic changes

- Legal principles such as the recognition of journalists in the law on public benefit purposes should be debated or, in some cases, established. Public-benefit journalism (which includes science journalism) should be further researched and purposely supported.
- Quality public service journalism about science should be bolstered through greater involvement by scientific organisations in broadcasting boards.
- Communication by scientists themselves with non-scientific members of the public should comply with guidelines, avoid exaggeration and advance good science communication.
- Providing financial support for science journalism in the digital era is a matter for many different stakeholders. Scientific institutions, public broadcasters, publishers, companies, NGOs, foundations and state bodies should all make a long-term contribution.



Starting point and vision

Starting point: science journalism is of systemic significance, but endangered

In all its breadth, science is a driver of accelerating social change and has a far-reaching influence on social decision-making. Therefore, open and mutual communication between science, society and politics is also of increasing importance for robust democratic opinion formation and decision-making. Journalism that covers the full spectrum of science and technology in turn constitutes a supporting pillar of this communication process: as a skilled, independent external observer of science with a social focus.

Quality journalism about science goes far beyond merely translating or explaining research. Science journalism sensitises and equips society to become aware of the contributions of science to debates and decisions, to critically evaluate these and take them into account. Science journalism puts society's questions and challenges to science. It is an independent, critical observer of the topics, methodologies, findings and structures of science.

Just like journalism in general, science journalism serves society in a twofold manner: on the one hand, it explains its subject to the public; on the other hand, it helps the public to form a realistic image of this subject and its agents through continuous and critical reporting – in this case, of science and researchers.

It would be impossible for these tasks to be fulfilled either by well-meaning or high-quality dialogue, PR or marketing from within science itself, because these cannot adopt the perspective of an independent external observer.

Journalism is currently experiencing a rupture, in the form of the digital transformation. This is not only disrupting journalistic products and modes of representation, as well as the media consumption of recipients. It is also causing the erosion of journalistic business models (loss of advertising income and declines in subscriptions) and leading to a creeping loss of the discourse-ordering function of journalism. Digitalisation pluralises information and exchanges of opinion, but it also encourages the formation of filter bubbles and facilitates disinformation campaigns.

Yet quality journalism about relevant sciences has been especially in demand during the months of the COVID-19 pandemic in particular. The pandemic has also made clear that we need to take extremely diverse scientific disciplines into account: in addition to the findings of medical, infectiological and epidemiological research, we also need the findings of e.g. the educational, social, behavioural and economic sciences. There is greater demand than ever before for quality journalism about science in relation to all these areas.

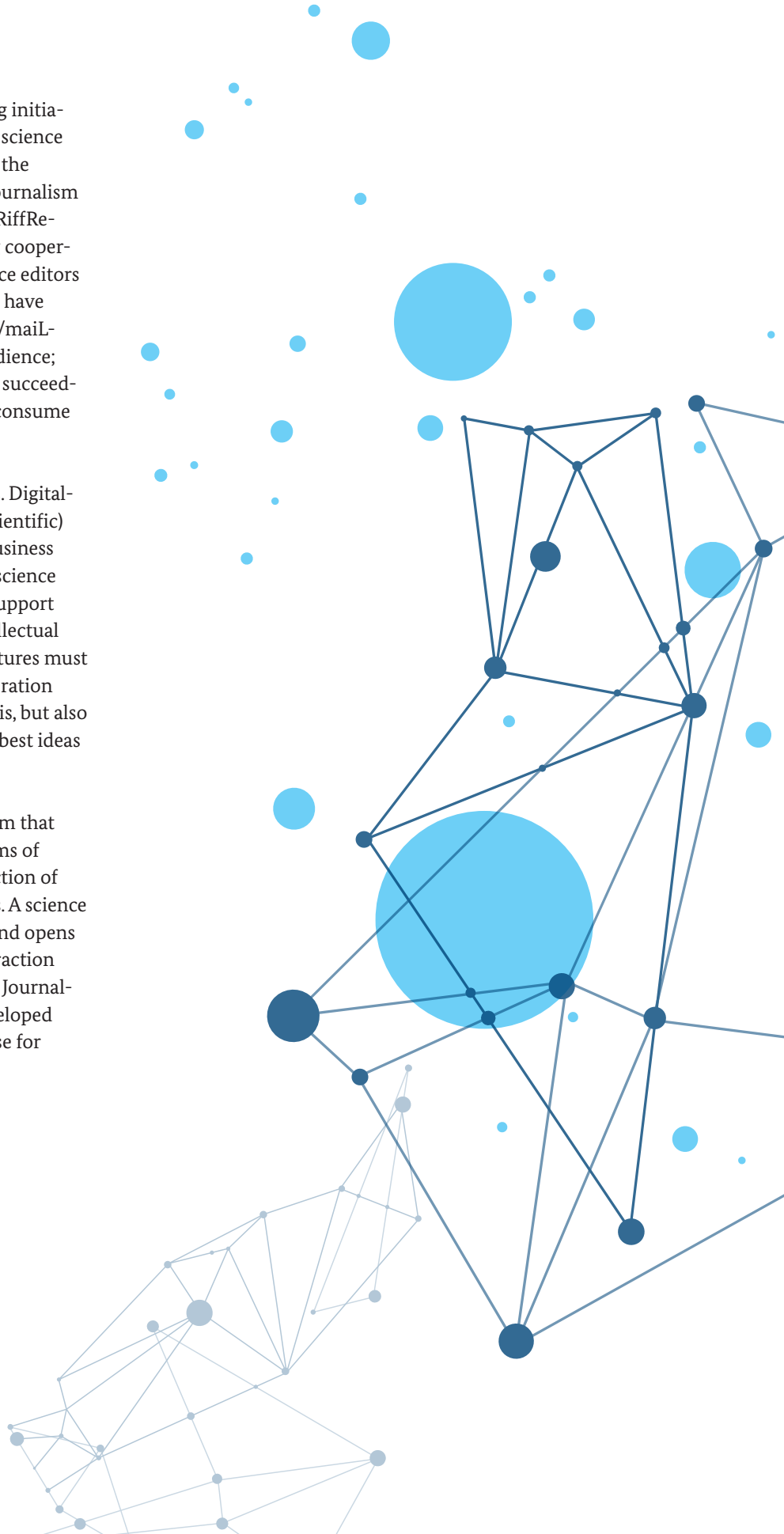
The increased journalistic consumption prompted by the pandemic has not, however, provided the media with any additional income. On the contrary, advertising revenues are falling, and there is little willingness to pay for online content. The situation underlines the social need for vibrant science journalism and for this to be supported through the digital transformation for the public benefit.

Vision

There have already been numerous promising initiatives that inspire hope for strong and vibrant science journalism in the digital era. A few examples: the Science Media Center Germany is a science journalism intermediary which is capable of expansion. RiffReporter (see www.riffreporter.de) is developing cooperative models of science journalism. The science editors at SWR [German regional public broadcaster] have established maiLab (see www.youtube.com/c/maiLab/about), a YouTube channel with a wide audience; during the COVID-19 pandemic, the channel succeeded in reaching many individuals who barely consume traditional journalistic media any more.

These pioneers should be followed by settlers. Digitalisation offers many new opportunities for (scientific) journalistic provision and new journalistic business models. Successful digital transformation in science journalism calls for collaboration with, and support from, science, politics and society – both intellectual and financial. For this purpose, existing structures must be created or strengthened to establish cooperation and support on a long-term, institutional basis, but also to maintain commercial competition for the best ideas as well as journalistic independence.

Our vision is of a digital-era science journalism that develops and deploys new tools and new forms of representation, that reaches a wider cross-section of society and that devises new business models. A science journalism that facilitates new career paths and opens up new opportunities for transition and interaction between science and journalism. The Science Journalism in the Digital Era working group has developed proposals to achieve this, and we present these for debate below.



Recommendations for action

Research and innovation policy

Strengthen research into science journalism in the digital era

In order to fulfil its function for the public benefit, science journalism needs to reach the full breadth and diversity of society. Science communication research can support it in this undertaking:

- In addition to investigating public acceptance of science, it can also investigate the acceptance and uptake of journalism about science and can ask which social groups consume science journalism and why – or why not.
- It can document the socio-economic and structural changes within the group of journalists who report on different scientific fields and use this basis of reliable figures to render developments within science journalism visible, (internationally) comparable and thereby suitable for evidence-based discussion.
- It can research how science journalism can better reach these target groups.
- It can analyse the growing role of science journalism, for example by referring to the COVID-19 pandemic.
- On the basis of these findings, it can help to carry forward positive developments such as the closer networking of science journalism with other areas of journalism, e.g. politics and business, into the "post-COVID" era – science journalism is important across the board.
- It can track and evaluate measures for the promotion of science journalism.
- It can furthermore assist in enhancing the position of user research/demand analysis within science journalism and can support the development of new digital business models.

Support new developments, collaboration and transfer through innovation programmes and formats for interaction

Innovation calls for collaboration and money – which is currently lacking, owing to the crisis in (science) journalistic business models. There is a lack of permanent funding and financiers prepared to be involved over the long term.

The public authorities should therefore establish or boost competitive funding lines. Structured innovation programmes should be developed at national level to support science journalism as it undergoes digital transformation (both financially and intellectually, in terms of coaching, mentoring, transfer of expertise). Incentives for cross-sectoral collaboration amongst stakeholding journalists and with secondary stakeholders (including with science, technology companies, start-ups) are particularly effective ways of accelerating innovation. Collaborations between (science) journalism, science, digital companies and start-ups could therefore also play a role in innovation programmes of this type. Within these innovation programmes, they could be provided with flexible, long-term support. A positive international example is the Vienna Media Initiative.

The public authorities should simultaneously strengthen training and further education provision for journalists in the area of innovation. This could be coordinated via the training academy for science journalists detailed below, and linked with the provision offered by an institute for non-profit journalism (also detailed below). In this way, financial support for innovation and entrepreneurial projects should be combined with supplementary training and coaching. Journalists thereby gain improved access to knowledge relating to innovation, and to professional and expert guidance in the area of innovation. A good example is the SVDJ Accelerator in the Netherlands (see https://www.svdj.nl/regeling/innovatieregeling/).

A further option for promoting practical transfer is the establishment of thematically-focused networks of journalists to address urgent social issues, using both public and private funding. New topics will also be introduced on an ongoing basis via a supplementary, non-subject-specific **innovation fund**.

A funding programme for journalists could support research and residencies at scientific institutions, in order to strengthen journalists' thematic range, subject knowledge and understanding of scientific processes.

A key challenge for practical transfer is obtaining permanent funding for debate and conference formats. "WissensWerte" and "Scicar" (for data journalists) are examples of dialogue platforms; their sponsoring organisations are willing to continue and further develop these projects. Longer-term financing could be secured by e.g. firm funding commitments from organisations within the Allianz der Wissenschaften, from the Federal Ministry of Education and Research and from the academies. As conference formats of this type continue to be developed, greater involvement of key groups of experts from outside journalism should be sought in order to support digital transformation within the profession.

Bring together data science and data journalism in a "Science Center for Computational Journalism"

Data is becoming increasingly important, both for journalists and for the information-seeking public. The COVID-19 pandemic has highlighted this fact. The media do not have sufficient staff or resources to systematically develop expertise in data journalism. A "Science Center for Computational Journalism" (SCCJ) could support media producers in doing so.

The SCCJ would provide services relating to data science and data journalism on a pre-competitive basis, free of charge. It could be established as an affiliate of a higher education institution. Scientists and journalists could work together there to jointly create products and services based on data and of relevance to journalism. Suitable higher education institutions would include those with appropriate subject departments (statistics, computer science, AI, journalism); the potential to interface with data science initiatives and research institutes (e.g. SOEP, GESIS) should be borne in mind here.

Competence development and support for early-career journalists

Science journalism, media competence and innovation all have a place in the curriculum

Students across all disciplines should acquire media skills as well as knowledge of science journalism and the career options it offers. Embedding this within the curriculum for each discipline (early in foundation courses) has three key benefits:

1. **Budding scientists gain an understanding of the function of journalistic media and how it operates. They can therefore work more effectively with these media at a later stage in their careers.**

2. **Students become familiar with the professional field of science journalism at an early stage. If they so desire, they can then purposely choose this career path.**

3. **If students move into jobs outside science and journalism later on, they will derive enormous benefit from their enhanced understanding of the media when confronting personal or social issues.**

Building on the foundation of #FactoryWisskomm, a concept should be developed to inspire higher education institutions and the federal states which are responsible for these to establish corresponding teaching provision. The government could make a recommendation to the federal states and supply financial support for relevant initiatives.

These proposals intersect with the discussions within the Competence Development working group.

To complement these actions, curricula in the fields of media/journalism/communication should be expanded to include research skills relating to science, data journalism, artificial intelligence, automation and innovation in greater depth. These modules could also be opened up to students from disciplines such as e.g. social studies and economics, computer science. Degree courses and further education relating to science journalism should impart expertise in innovation – especially relating to start-ups and business models. This expertise will transform science journalism in the digital era into a dynamic career with good prospects. An invitation for higher education institutions to tender for "Science journalism innovation labs", with the potential to collaborate with non-university research institutes, would drive this plan forwards. It might also be possible to establish links with journalists and media publishers, as well as with innovation labs at higher education institutions.

Establishment of a mentoring programme

There is a dearth of young science journalists. A mentoring programme for early-career scientists would support a transfer from other courses by those suitably qualified at the end of degree programmes. Thanks to a successful mentoring programme which ran from 2004 to 2011, experience is already available to draw on, as is a network of media companies who are happy to collaborate. Numerous alumni of this mentoring programme are now employed with leading science publications. A new mentoring programme should be designed to take account of the changed framework conditions and professional remit of science journalism in the digital era.

Foundation of a training academy for science journalists

Knowledge and methods for the digital era should be systematically taught in science journalism. This instruction could be delivered by a non-profit training academy. It would make skills such as AI-/data-based research methodologies more accessible to journalists. It would optimise tools for "augmented science journalism", make them available free of charge and organise workshops and beta testing. A training academy could be run jointly by the Social Media Center Germany (SMC Germany) and WPK – the German Science Journalists' Association.

Establish traineeships in science journalism for postdocs

Funded traineeships for postdocs could open up new possibilities for transition between careers in science and journalism and could help to keep relevant career options open for longer. They should be made available to particularly qualified and engaged postdocs. These individuals will gain in-depth insight into the media system and its expectations of the science system as a result. Traineeships at the Science Media Center Germany would be especially ideal. SMC Germany is in a position to supply insights and impart expertise through traineeships in science journalism and would in turn benefit from the presence of committed scientists engaged in cutting-edge research who would bring new topics and methods with them. This would result in interactions between science and journalism at the level of individual personnel. SMC Germany trainees would develop an understanding of career options in both science and journalism, as well as the alternative career of "public-interest scientist". Stipends for the traineeships could be financed jointly by scientific organisations.

Intermediaries and funding structures

Collaboration with, support for and promotion of science journalism requires organising structures. Owing to their mutual interest in good-quality social communication about and with science, research

organisations, higher education institutions and non-university scientific institutions should participate in these structures. Success in establishing structures to promote transformation in science journalism could offer a template for other areas of journalism.

A basic condition is the preservation of journalistic independence. Intelligently designed intermediary structures can serve to preserve and embed this independence. Independence must be ensured in a twofold manner: in relation to public and private funding bodies, as well as in relation to science as the subject of external observation by science journalism. Science itself provides an example of how independence can be maintained. It receives public funding but allocates it independently in accordance with scientific criteria.

The Science Journalism in the Digital Era working group has developed and elaborated (complementary) options for supporting the joint leap into the digital era:

Strengthen intermediaries and continue to develop their science journalism provision

We should strengthen existing structures within journalism in general (including the innovation labs accommodated at the state media institutes) and/or align these more closely with science journalism. The Science Media Center Germany (SMC Germany, in association with the SMC-Lab, see www.sciencemediacenter.de) is a new intermediary focused on science journalism that can support journalists in assessing science-related topics rapidly and competently, to take account of these in their own contributions and to utilise new methods in information technology. More funding organisations (science, science funders and media) should contribute to expanding the capacity of the editorial and development departments of the SMC. Intermediaries from other areas of journalism should also develop more provision related to science journalism.

Science journalism in the regional media – via a non-profit RegioScienceDesk

Owing to immense financial pressures, local and regional media are losing the ability to engage in science journalism. They are becoming increasingly reliant on PR or advertising agencies for their content and are limiting coverage to mainstream issues (service, medicine/health, technology). The working group proposes the establishment of a not-for-profit RegioScienceDesk: an editorial team producing science journalism for local and regional newspapers. Since the different regional media do not compete with each other, there is no effective regional market for science journalism and the content would be free of charge, an editorial team of this type would not constitute a critical market intervention. It would, however, permit smaller regional newspapers to offer expert science reporting despite a lack of resources. A RegioScienceDesk could be financed by means of a multi-funder model, following the example of SMC Germany.

Establishment of a German “Verbrauchsstiftung” or spend-down foundation

The WPK (German Science Journalists’ Association) has developed the model of a spend-down foundation for the financial support of science journalism during the digital transformation: the foundation capital could be gradually disbursed over ten years (e.g. one million euros annually if the capital is ten million euros). The stipulated time limitation ensures that funding measures will result in viable innovations. The trust committee should be predominantly composed of journalists, in order to guarantee independence when awarding funding. At the same time, it should also include experts from science and business, amongst other areas, who are competent to assess the potential of proposals for journalistic innovation. The trust should focus on supporting programmes for innovation in journalism similar to those that already exist in e.g. the Netherlands, the UK, Denmark and Austria.

Systemic changes

Legally recognise, fund and research non-commercial, public-interest journalism

In addition to public service broadcasting and private commercial publishers, non-commercial, public-interest journalism is emerging as the third pillar of our media system. This trend is discernible in Germany but is already much more apparent in some other countries. Non-profit journalism can counteract the failure of the market particularly in areas that are especially important for the formation of social opinion, that are research- or resource-intensive yet frequently often precariously funded (such as investigative, science or international reporting). Pioneers in this field, such as the Science Media Center Germany, MedWatch and the RiffReporters, as well as funding initiatives such as those by the Schöpflin Foundation and the Rudolf Augstein Foundation, should be followed by settlers. To this end, legal certainty must be created, continuing education options provided and gaps in the research into non-profit journalism must be closed. The legal foundations for wider support for public-interest journalism should be debated and established in the German Parliament and the legislative process. We propose:

1. **the inclusion of journalism in the law on public benefit purposes, to make it easier to found public benefit media provision and to open up extra funding options;**

2. **the establishment of a continuing education programme for journalists and entrepreneurs, enhanced by an incubator for public-benefit innovations in science/data journalism (potentially linked with the training academy for science journalism described above);**

3. **the establishment of an institute for public-benefit journalism, affiliated with a higher education institution; this would research the economic and practical dimensions and the media politics of non-profit journalism and would ensure knowledge transfer.**

Strengthen quality journalism about science in public-service broadcasting – through greater involvement in broadcasting boards

The role of science journalism within public-service broadcasting should be reinforced. In accordance with their remit, public service broadcasters should consolidate their expertise in science journalism, both with respect to scientific formats, including increasing budgets for freelance journalists, and with regard to quality contributions by science journalists to daily news outputs. Representatives from science and politics on media boards, such as broadcasting councils, should use their influence to promote the reinforcement of science journalism. Scientists should be encouraged by their employers or funding organisations to also become involved in committees of this type.

Intensive communication between science, journalism and society – although without exaggeration and in accordance with ethical guidelines

Knowledge transfer, whether taking place via input for science journalism or direct communication with society, should be regulated by means of research ethics. Disciplined behaviour by individual scientists is essential to prevent exaggeration (overselling) of the relevance of their own area of research. Higher education institutions, non-university research institutes and scientific bodies should comply with guidelines in their communication provision. Science in general should furthermore pay closer attention to principles of good science communication in their guidelines on ensuring good scientific practice. This also includes illuminating social debates from different disciplinary perspectives.

Early-career scientists should be systematically taught the principles of good science communication during their doctoral studies.

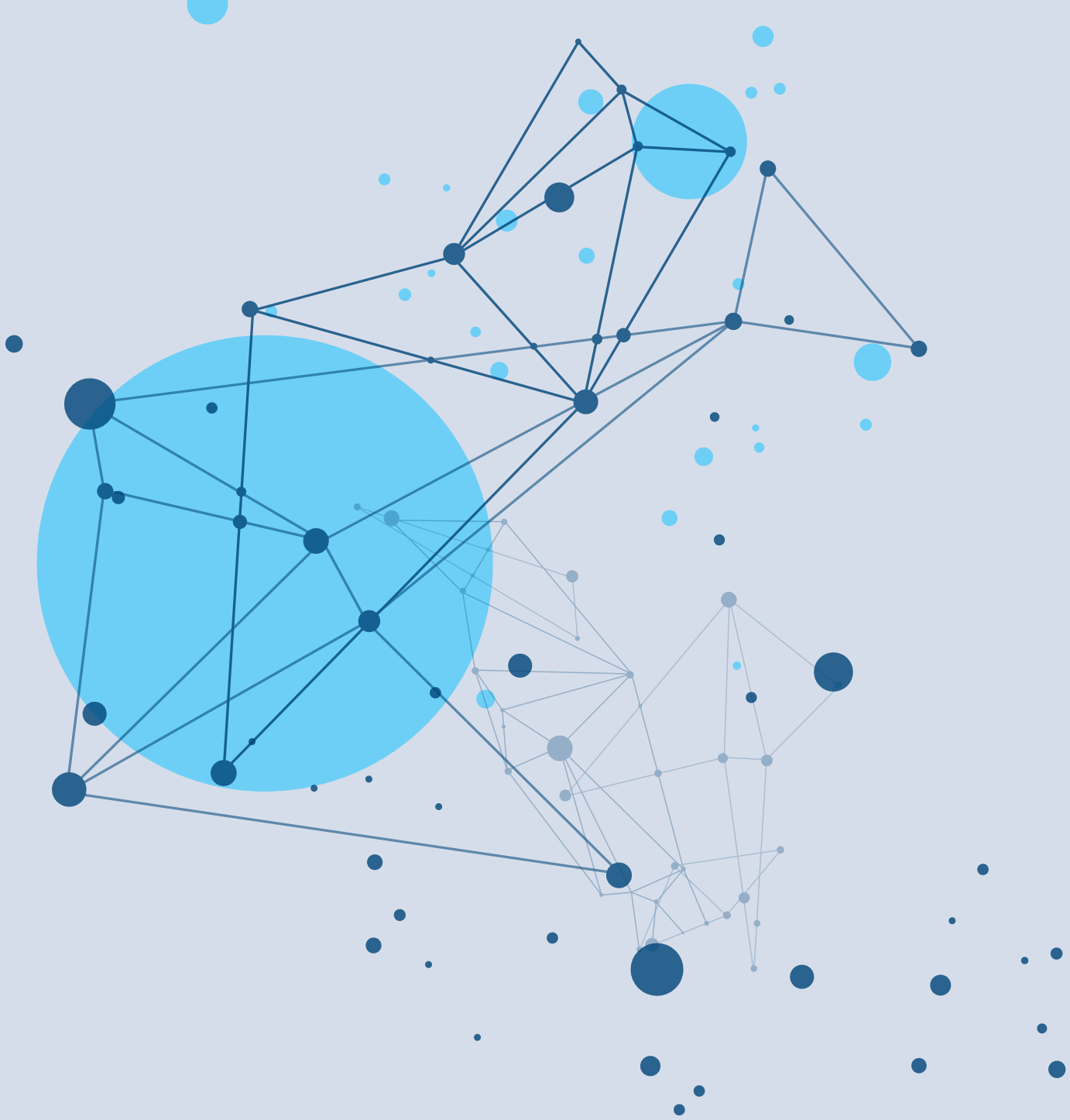
Science should collectively promote science journalism

Scientific organisations and higher education institutions should collectively promote science journalism for the purpose of public benefit (above and beyond individual media work), in order to improve transfer between science and society and thereby also to strengthen the knowledge-based formation of democratic opinion. Owing to their mutual interest in good social communication about and with science, research organisations, higher education institutions and non-university research institutes should participate in the structures described above.

	Participants											
Action options	Media publishers	Public service media	Media – inter-mediaries	Media – regula-tion*	Schools of journalism	Sci. orgs	Higher education institution	Private funding bodies	Companies	Politics – Federal	Politics – State	
Innovation programmes	A	A	A	B	C	A	A	C	A	A	B	Research and innovation policy
Science Center for Com-putational Journalism	C	C	A	C	C	B	A	C	C	A	B	
Research into science journalism	C	C	C	C	C	B	A	B	C	A	B	
Science journalism and innovation in the curriculum	C	C	C	C	B	B	A	C	C	B	B	Support for early-career journalists
Science journalist mentoring programme	A	A	A	C	C	A	C	A	C	C	C	
Digital innovation in science journalism training academy	C	C	A	C	C	B	C	A	C	B	C	
Funded traineeships for postdocs	C	C	A	C	C	A	C	C	C	C	C	
Strengthening inter-mediaries such as SMC Germany	C	C	C	C	C	A	A	A	C	C	C	Intermediaries and funding structures
Strengthening science journalism provision at state media institutes	C	B	C	A	C	C	C	C	C	C	B	
Foundation of a RegioScienceDesk	C	C	A	C	C	A	A	A	C	C	C	
Definition of funding structure (e.g. spend-down foundation)	B	B	A	C	C	B	B	A	C	A	C	
Inclusion of non-profit journ. in the law on public benefit	C	C	C	C	C	C	C	C	C	A	A	Systemic changes
Training programme and Institute for Non-Profit Journ.	C	C	B	C	B	B	A	B	C	B	B	
Strengthening sci. journ. in public broadcasting (incl. broadcasting boards)	C	A	C	C	C	A	A	C	C	C	C	
Ethical guidelines for science communication	C	C	C	C	C	A	A	C	C	C	C	

* Media – regulation incl. state media institutes

A dark blue = core participants B blue = participants C light blue = non-participants



SOURCES

Nationale Akademie der Wissenschaften Leopoldina, Deutsche Akademie der Technikwissenschaften – acatech, Union der deutschen Akademien der Wissenschaften (2014): Zur Gestaltung der Kommunikation zwischen Wissenschaft, Öffentlichkeit und den Medien, available from: https://www.leopoldina.org/uploads/tx_leopublication/2014_06_Stellungnahme_WOeM.pdf (accessed on 9 May 2021).

Wissenschaftsrat (2016): Wissens- und Technologietransfer als Gegenstand institutioneller Strategien – Positionspapier, available from: https://www.wissenschaftsrat.de/download/archiv/5665-16.pdf?__blob=publicationFile&v=1 (accessed on 9 May 2021).

Wissenschaftsrat (2021): Impulse aus der COVID-19-Krise für die Weiterentwicklung des Wissenschaftssystems in Deutschland, available from: https://www.wissenschaftsrat.de/download/2021/8834-21.pdf?__blob=publicationFile&v=15 (accessed on 9 May 2021).

Allianz der Wissenschaftsorganisationen (2020): 10-Punkte-Plan zur Wissenschaftskommunikation, available from: https://www.leopoldina.org/fileadmin/redaktion/Presse/10_Punkte_Plan.Allianz.Wissenschaftskommunikation.pdf (accessed on 9 May 2021).

Bundesverband Hochschulkommunikation, Wissenschaft im Dialog (2016): Leitlinien zur guten Wissenschafts-PR, available from: https://www.wissenschaft-im-dialog.de/fileadmin/user_upload/Trends_und_Themen/Dokumente/Leitlinien-gute-Wissenschafts-PR_final.pdf (accessed on 9 May 2021).

Lühnen J, Albrecht M, Mühlhauser I, Steckelberg A (2017): Leitlinie evidenzbasierte Gesundheitsinformation, available from: http://www.leitlinie-gesundheitsinformation.de/ (accessed on 9 May 2021).

Deutsche Forschungsgemeinschaft (2018): Leitlinien zur Sicherung guter wissenschaftlicher Praxis, available from: https://wissenschaftliche-integritaet.de/kodex/ (accessed on 9 May 2021).

Journalist.de (2020): Wiener Medieninitiative – Förderung nach Wiener Art, available from: http://www.journalist.de/startseite/detail/article/foerderung-nach-wiener-art (accessed on 9 May 2021).

#FactoryWisskomm –

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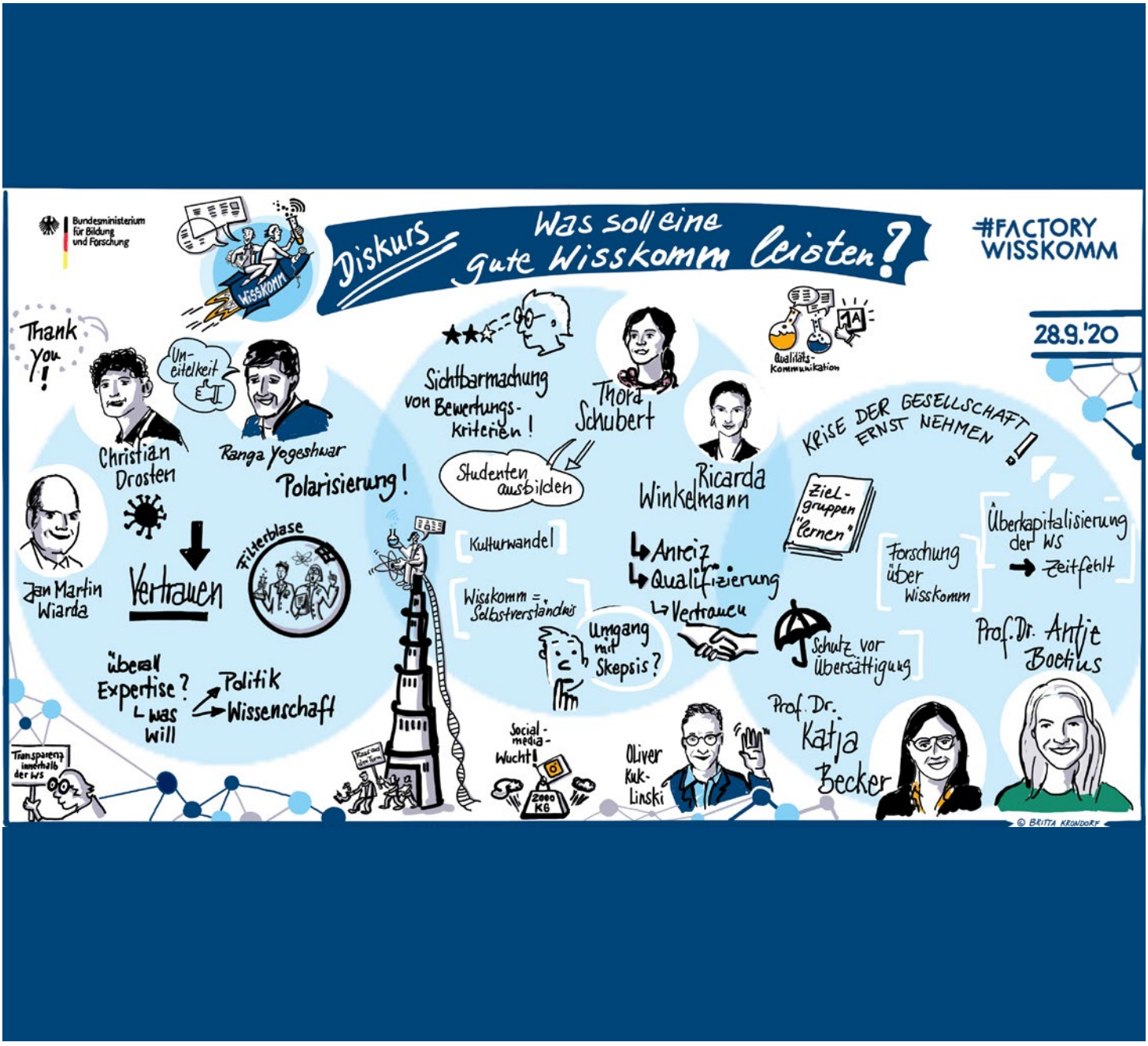
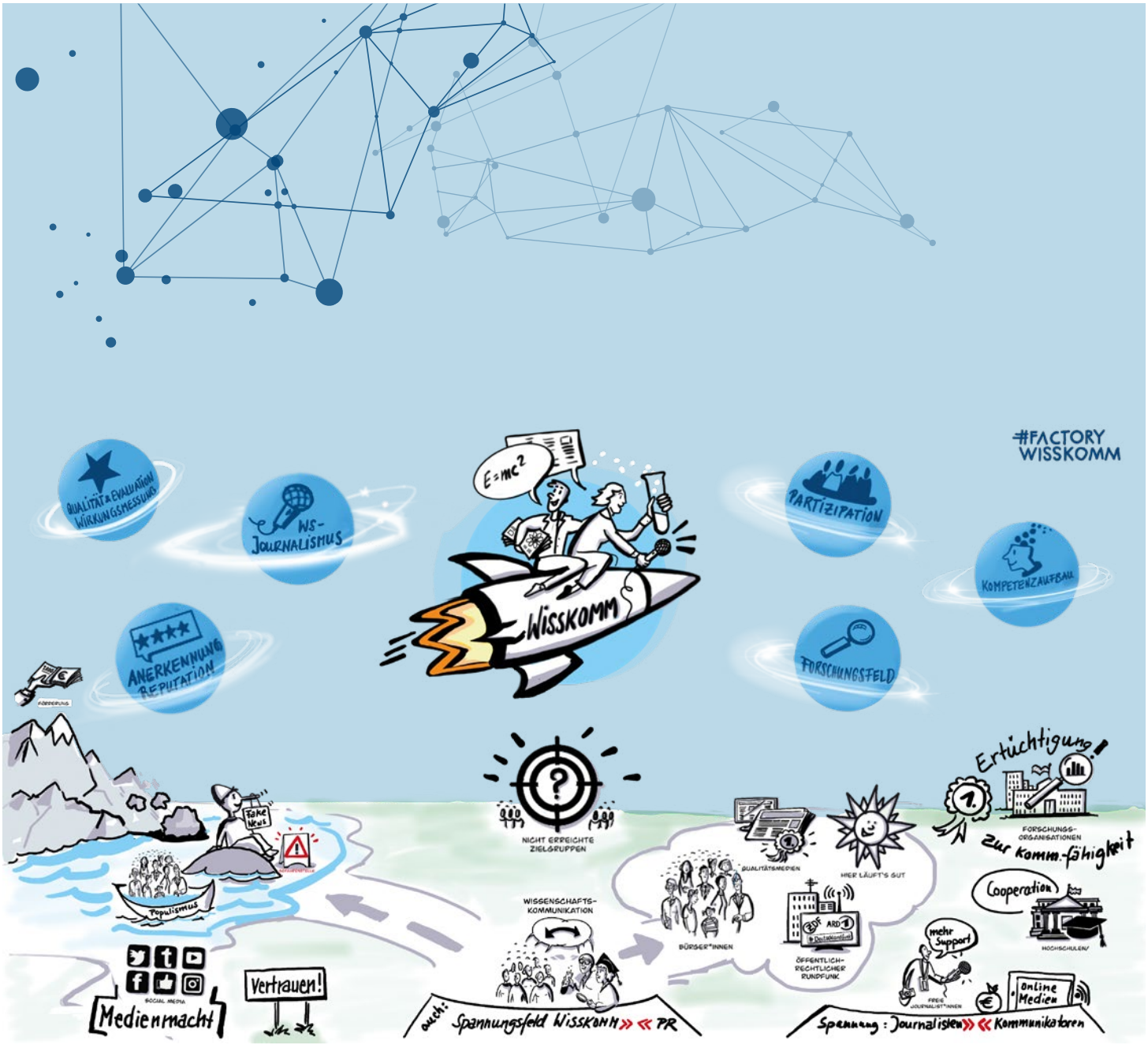
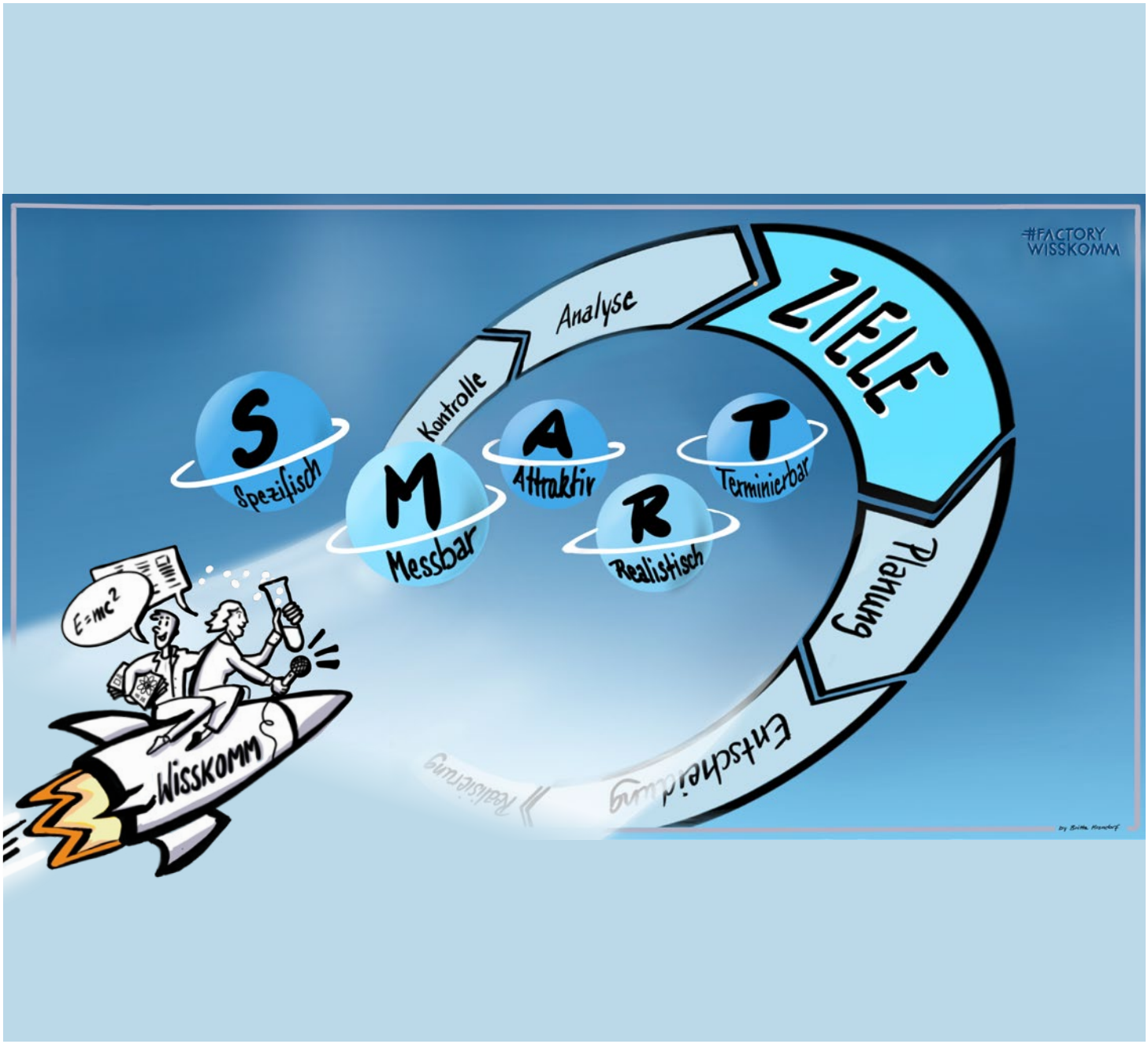
#FactoryWisskomm was observed by graphic recorder Britta Krondorf. A selection of her graphics is reproduced here. These document the process and how certain concepts were modified in the course of the working group phase.



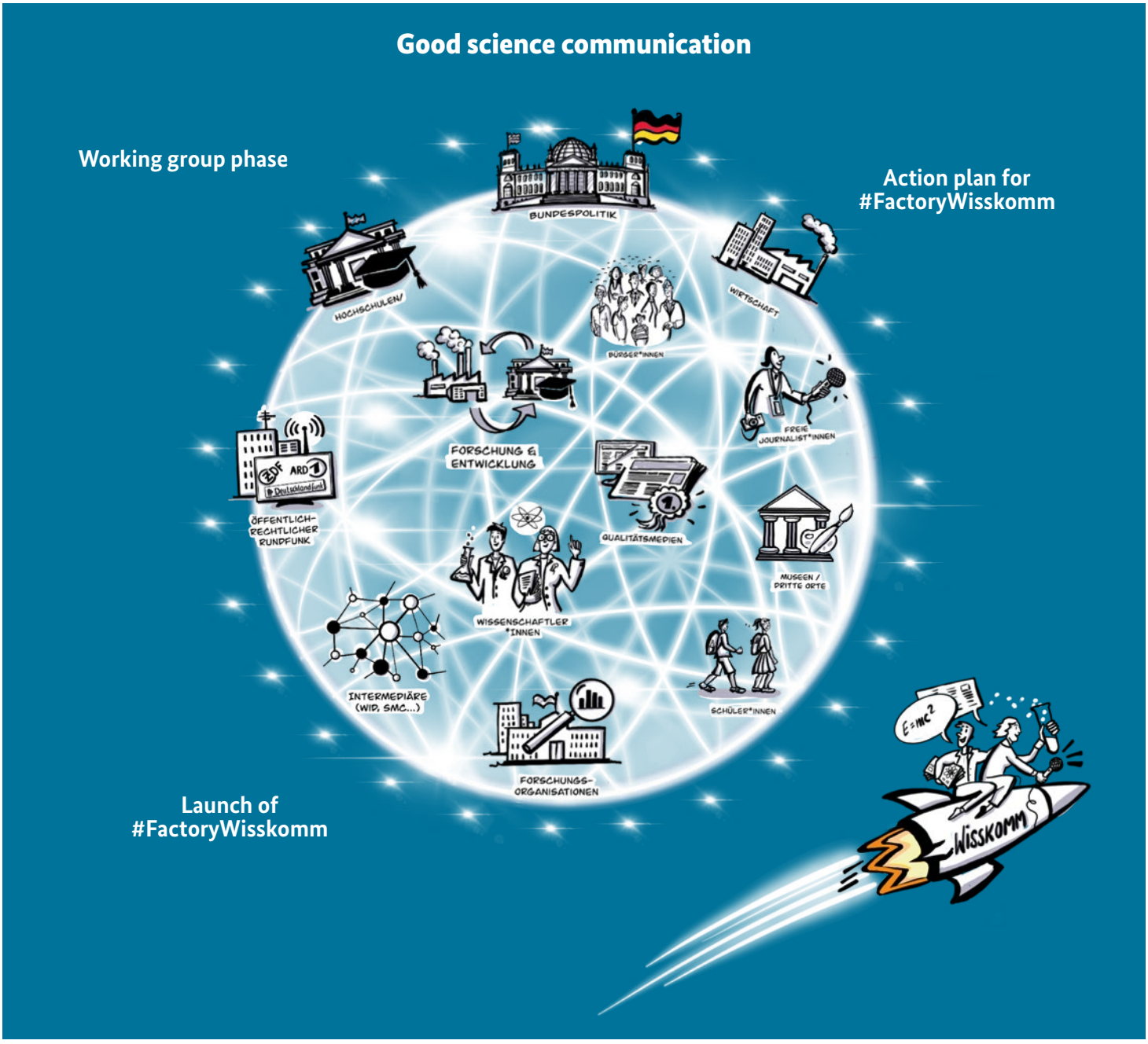
At the #FactoryWisskomm launch event at Westhafen in Berlin on 28 September 2020, moderated by Oliver Kuklinski and Jan-Martin Wiarda, the initial task was to define concepts and to determine the starting position: What should good science communication do? What is already going well? And where is action needed in particular?



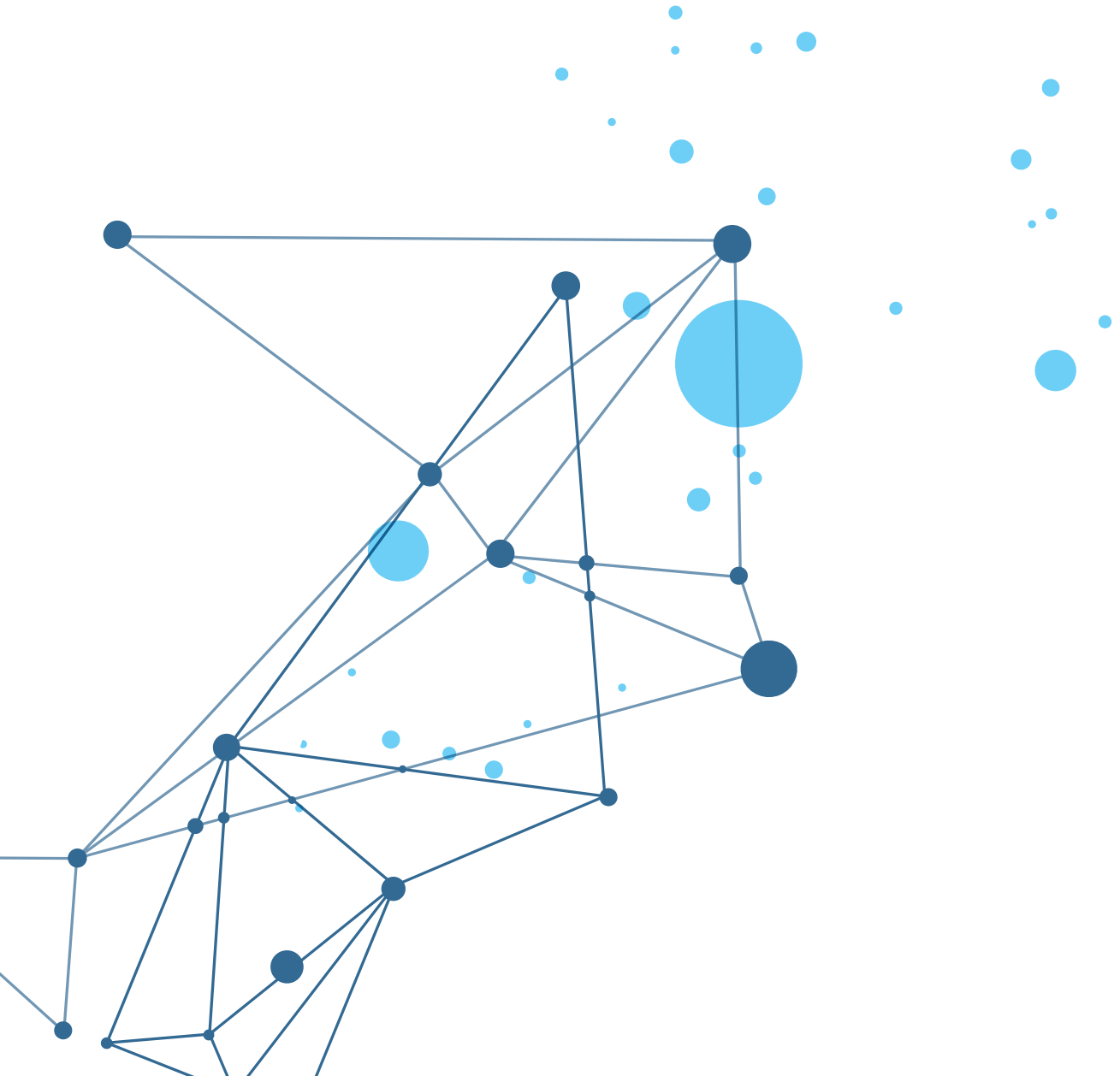
Working groups were formed to address six action areas. At this event, individuals from the scientific community undertook to act as specialist advisors for these working groups and to support them during the working group phase. Over the course of many virtual meetings, the working groups elaborated concrete prospects for action for science communication. In this way, they mapped the field of science communication.



The present recommendations are intended to be practicable and straightforward to implement. Therefore, at the start of the working phase, the participants were encouraged to strive for “SMART objectives”: specific, measurable, attractive, realistic and time-bound.



#FactoryWisskomm was conducted in three phases: the launch, the working group phase and, lastly, the presentation of the final publication – with the working title "#FactoryWisskomm Action Plan".



#FactoryWisskomm –

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