Vol. 16, No. 8, 2021

swiss academies of arts and sciences

swiss academies reports

swiss-academies.ch

Science in the Swiss Public

The State of Science Communication and Public Engagement with Science in Switzerland

Publication details

PUBLISHER
Swiss Academies of Arts and Sciences · Laupenstrasse 7 · Postfach · 3001 Bern, Switzerland
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academies_ch swiss_academies Swiss Academies of Arts and Sciences

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TRANSLATION
Carnegie Fund Services S.A.

LAYOUT
Push'n'Pull, Bern

PRINTING
Vögeli AG, Langnau

1st edition, 2021 (500 EN). Report can be obtained free of charge from the Swiss Academies of Arts and Sciences.

PROPOSED CITATION
Swiss Academies of Arts and Sciences (2021) Science in the Swiss Public. The State of Science Communication and Public Engagement with Science in Switzerland. Swiss Academies Reports 16 (8). http://doi.org/10.5281/zenodo.4974312

ISSN (print) 2297-8275
ISSN (online) 2297-184X

Science in the Swiss Public

The State of Science Communication and Public Engagement with Science in Switzerland

Report of the Expert Group "Communicating Sciences and Arts in Times of Digital Media" of the Swiss Academies of Arts and Sciences

SDGs: The international sustainability goals of the UNO

With this publication, the Swiss Academies of Arts and Sciences make a contribution to the SDG 4 „Ensure inclusive and equitable quality education and promote lifelong learning and opportunities for all" and to the SDG 9 „Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

› sustainabledevelopment.un.org

› eda.admin.ch/agenda2030/de/home/agenda-2030/die-17-ziele-fuer-eine-nachhaltige-entwicklung.html

Executive Summary

Background: Science communication and public engagement with science have repeatedly been called for in recent years, particularly during the COVID-19 pandemic. They are important because scientific expertise matters for many individual, organizational and societal decisions, but also because science and research rely on public acceptance and societal legitimation. But a comprehensive assessment of science communication and public engagement with science in Switzerland does not yet exist.

Mandate of the Expert Group: The Swiss Academies of Arts and Sciences set up the expert group "Communicating Sciences and Arts in Times of Digital Media" with a twofold mandate: First, it was asked to *assess the status quo of science communication and public engagement with science in Switzerland broadly and systematically.* Second, the expert group was mandated to identify potential improvements as well as recommendation for how to realize those improvements. Both the status quo assessment and the recommendations are part of this report.

Method: The report is based on a comprehensive review of the available interdisciplinary scholarship analyzing science communication and public engagement with science in Switzerland. Selectively, the report also incorporates original data, international findings, and secondary analyses where little or no published scholarly work was available. A first draft of the report was externally evaluated via pre-publication public review of preprint chapters on the "Open Science Framework" repository. A second draft of the report was sent out for pre-publication peer review to four internationally renowned scholars with expertise in science communication and public engagement who are familiar with the Swiss situation.

Results: Overall, the report covers a wide range of facets of science communication and public engagement in Switzerland, from public attitudes towards science over individuals and organizations engaging in science communication and engagement formats to news and social media representations of science:

CHAPTER 1 → Science-related Perceptions of the Swiss Population and their Sources of Information and Contact with Science

- The Swiss population associates "science and research" mostly with medicine and STEM disciplines.
- The Swiss population perceives science positively. Trust in science and scientists in Switzerland is high and seems stable over time.
- Most Swiss residents are knowledgeable about science and well equipped to understand science-related content.
- The Swiss population expects scientists to communicate to the public.
- But while public attitudes towards science are favorable in general, perceptions vary between different scientific topics and different subgroups of the population.
- The Swiss population regularly encounters science in their lives and through a broad set of media – most often online.

CHAPTER 2 → From Individual to Organizational Science Communicators: Who Engages with the Swiss Public?

- Most scientists think it is necessary and worthwhile to communicate and engage with the public.
- Scientists' actual communication and engagement efforts do not match these positive views towards science communication, however.

- Social and organizational factors influence scientists' public communication and engagement.
- Clear differences in public communication and engagement exist between scholars depending on their discipline, seniority, and gender.
- Institutions of higher education and scientific organizations have strongly emphasized, professionalized and expanded their public communication efforts in recent years.
- A broad range of other communicators – from museums over science centers to political, corporate and other stakeholders communicate about science-related issues.
- Only few Swiss influencers exist on social media that focus on science.

CHAPTER 3 → Science Journalism in Switzerland

- Journalists from various beats and backgrounds cover science-related topics and, thus, contribute to science journalism.
- Most specialized science journalists aim to provide objective information and orientation, and do not primarily aim to be watchdogs of science.
- Science journalism is facing significant challenges in the changing media ecosystem in Switzerland, and specialized science journalism is declining: There are about 100 specialized science journalists in the country, and only a small number of media houses featuring science desks. Science journalists work under increasingly challenging conditions.
- Several new models of science journalism are currently tried in Switzerland, aiming to balance editorial independence and high quality with economic sustainability.

CHAPTER 4 → Digital Platforms: The Role of Google, Facebook and Co.

- A lot of science-related content of strongly varying quality is available online and in social media.
- Digital platforms have become important and strongly used but, for many, also less trusted sources of information about science.
- For younger people, social media and particularly YouTube are important sources of science-related content.
- Platform architectures influence user perceptions and actions, sometimes with undesirable consequences for science communication.
- Digital platforms facilitate mis- and disinformation on scientific issues online, but also offer notable opportunities for science communication, e.g. for movement mobilization.

CHAPTER 5 → How Science is Publicly Presented and Discussed in Switzerland

- A variety of participatory and dialogical science communication formats are available to the Swiss public.
- The share of science-related news media coverage has risen in Switzerland in past decades. Science-related topics account for 1-3% of Swiss news media coverage.
- Scholars, themes, and disciplines from the arts and social sciences are prominent in Swiss media.
- News media coverage focuses strongly on a small number of individual scientists.
- News media reporting on science seems to be mostly accurate, but is vulnerable to biased framing and to the influence of organizational PR.

- The internet is the most likely source for the Swiss population to encounter inaccurate scientific content.

CHAPTER 6 → Recommendations for Science Communication and Public Engagement with Science in Switzerland

- Science communication should be an accepted part of science and valorized accordingly. Scholars should be offered training and social, psychological and legal support where necessary.
- Science communication should be dialogical where possible. Scholars should understand the perspectives of the public.
- Research into science communication should be fostered and translated into evidence-based science communication.
- Communication between science and politics needs to be strengthened and institutionalized.
- Science journalism needs to be strengthened – in public service and traditional media houses and among freelancers.
- A news funding infrastructure is needed to support science journalism in Switzerland.

While the report compiles a considerable amount of scholarship on these aspects in Switzerland, it also highlighted many gaps and biases in existing research. Broader, comprehensive assessments of science communication and public engagement with science in Switzerland as well as trend analysis tracking potential changes over time are largely lacking. Future research on science communication and public engagement with science in Switzerland should remedy these gaps.

Zusammenfassung

Hintergrund: Wissenschaftskommunikation und gesellschaftliches Engagement mit der Wissenschaft wurden in den letzten Jahren wiederholt gefordert, insbesondere während der COVID-19-Pandemie. Sie sind wichtig, weil wissenschaftliche Expertise für viele individuelle, organisatorische und gesellschaftliche Entscheidungen von Bedeutung ist, aber auch, weil Wissenschaft auf gesellschaftliche Akzeptanz und Legitimation angewiesen sind. Eine umfassende Bestandsaufnahme der Wissenschaftskommunikation und des gesellschaftlichen Engagements mit der Wissenschaft in der Schweiz gab es bislang allerdings nicht.

Mandat der Expertengruppe: Die Akademien der Wissenschaften Schweiz haben die Expert:innengruppe «Communicating Sciences and Arts in Times of Digital Media» mit einem doppelten Mandat eingesetzt: Erstens soll sie den *Status quo von Wissenschaftskommunikation und gesellschaftlichem Engagements mit der Wissenschaft in der Schweiz systematisch erfassen. Zweitens soll sie Verbesserungspotenziale identifizieren und entsprechende Empfehlungen erarbeiten.* Sowohl die Erfassung des Status quo als auch die abgeleiteten Empfehlungen sind Teil dieses Berichts.

Methode: Der Bericht basiert auf einer umfassenden Sichtung der interdisziplinären Forschung zu Wissenschaftskommunikation und gesellschaftlichem Engagement mit der Wissenschaft in der Schweiz. Zu Aspekten, zu denen wenige veröffentlichte wissenschaftliche Arbeiten verfügbar waren, bezieht der Bericht auch Primärdaten, internationale Befunde und Sekundäranalysen ein. Ein erster Entwurf des Berichts wurde öffentlich evaluiert, indem Preprints der einzelnen Kapitel auf dem «Open Science Framework»-Repository abgelegt und Stakeholder um Feedback gebeten wurden. Ein überarbeiteter Entwurf des Berichts wurde dann von vier international renommierten Wissenschaftler:innen mit einschlägiger Expertise und Kenntnis der Schweizer Situation begutachtet.

Ergebnisse: Der Bericht deckt vielfältige Facetten der Wissenschaftskommunikation und des öffentlichen Engagements in der Schweiz ab – von öffentlichen Einstellungen zu Wissenschaft über individuelle und organisationale Wissenschaftskommunikator:innen bis hin zu Darstellungen von Wissenschaft in journalistischen Medien und sozialen Medien:

KAPITEL 1 → Wissenschaftsbezogene Wahrnehmungen der Schweizer Bevölkerung, ihre Informationsquellen und Kontakte mit Wissenschaft

- Die Schweizer Bevölkerung assoziiert «Wissenschaft und Forschung» hauptsächlich mit Medizin und MINT-Disziplinen.
- Die Schweizer Bevölkerung nimmt Wissenschaft positiv wahr. Das Vertrauen in Wissenschaft und Wissenschaftler:innen ist hoch und scheint über die Zeit stabil zu sein.
- Die meisten Schweizer:innen wissen über Wissenschaft Bescheid und sind fähig, wissenschaftsbezogene Inhalte zu verstehen.
- Die Schweizer Bevölkerung erwartet von Wissenschaftler:innen, dass sie mit der Öffentlichkeit kommunizieren.
- Obwohl die Einstellung der Bevölkerung gegenüber der Wissenschaft allgemein positiv ist, variieren diese Einstellungen bei verschiedenen wissenschaftlichen Forschungs- und Anwendungsfeldern sowie zwischen Untergruppen der Bevölkerung.
- Die Schweizer Bevölkerung begegnet der Wissenschaft regelmässig in ihrem Leben und in einer breiten Palette von Medien – am häufigsten online.

KAPITEL 2 → **Von individuellen zu organisatorischen Wissenschaftskommunikator:innen: Wer kommuniziert mit der Schweizer Öffentlichkeit?**

- Die meisten Wissenschaftler:innen sind bereit, mit der Öffentlichkeit zu kommunizieren.
- Die tatsächlichen Kommunikationsbemühungen von Wissenschaftler:innen bleiben jedoch hinter diesen positiven Ansichten zur Wissenschaftskommunikation zurück.
- Soziale und organisatorische Faktoren beeinflussen das kommunikative Engagement von Wissenschaftler:innen.
- Es gibt deutliche Unterschiede im kommunikativen Engagement von Wissenschaftler:innen je nach Disziplin, Seniorität und Geschlecht.
- Hochschulen und Wissenschaftsorganisationen haben ihre Aussenkommunikation in den letzten Jahren priorisiert, professionalisiert und ausgebaut.
- Ein breites Spektrum weiterer Kommunikator:innen – von Museen über Science Center bis zu Politik, Unternehmen und anderen Stakeholdern – kommunizieren über wissenschaftsbezogene Themen.
- In sozialen Medien gibt es nur wenige Schweizerische Influencer zu Wissenschaftsthemen.

KAPITEL 3 → **Wissenschaftsjournalismus in der Schweiz**

- Journalisten:innen aus verschiedenen Ressorts berichten über wissenschaftsbezogene Themen und tragen so zum Wissenschaftsjournalismus bei.
- Schweizerische Wissenschaftsjournalist:innen versuchen vornehmlich, objektiv zu informieren und Orientierung zu bieten. Kritik und Kontrolle der Wissenschaft stehen dahinter zurück.
- Angesichts des Medienwandels in der Schweiz steht der Wissenschaftsjournalismus vor grossen Herausforderungen und erlebt einen Rückgang: Es gibt etwa 100 spezialisierte Wissenschaftsjournalisten:innen und nur eine kleine Anzahl von Medienhäusern mit eigenen Wissenschaftsredaktionen. Die Arbeitsbedingungen von Wissenschaftsjournalisten:innen verschlechtern sich.
- Derzeit werden in der Schweiz neue Modelle des Wissenschaftsjournalismus ausprobiert, die versuchen, redaktionelle Unabhängigkeit und hohe Qualität mit wirtschaftlicher Nachhaltigkeit in Einklang zu bringen.

KAPITEL 4 → **Digitale Plattformen: Die Rolle von Google, Facebook und Co.**

- Auf digitalen Plattformen sind viele wissenschaftsbezogene Inhalte von stark variierender Qualität verfügbar.
- Digitale Plattformen sind wichtige und stark genutzte, aber für Viele auch weniger vertrauenswürdige Informationsquellen zu Wissenschaftsthemen.
- Für jüngere Menschen sind soziale Medien und insbesondere YouTube wichtige Quellen für Wissenschaftsthemen.
- Die Architektur digitaler Plattformen beeinflusst die Wahrnehmungen und Handlungen der Nutzer:innen, teils mit unerwünschten Folgen für die Wissenschaftskommunikation.
- Digitale Plattformen erleichtern die Verbreitung von Dis- und Misinformation zu Wissenschaftsthemen, bieten aber auch neue Möglichkeiten für die Wissenschaftskommunikation, z.B. für die Mobilisierung sozialer Bewegungen.

KAPITEL 5 → Wie Wissenschaft in der Schweiz öffentlich präsentiert und diskutiert wird

- Der Schweizer Bevölkerung steht eine Vielzahl partizipativer und dialogischer Formate der Wissenschaftskommunikation zur Verfügung.
- Der Anteil der wissenschaftsbezogenen Berichterstattung in Schweizer Medien ist in den letzten Jahrzehnten angestiegen. Wissenschaftsbezogene Themen machen 1-3% der Berichterstattung von Schweizer Nachrichtenmedien aus.
- Forscher:innen und Themen aus den Geistes- und Sozialwissenschaften sind in Schweizer Medien prominent vertreten.
- Die Wissenschaftsberichterstattung der Schweizer Nachrichtenmedien konzentriert sich auf eine kleine Zahl einzelner Wissenschaftler:innen.
- Die Berichterstattung der Nachrichtenmedien über Wissenschaft ist überwiegend akkurat. Sie ist aber anfällig für ein verzerrtes Framing und den Einfluss von organisationaler PR.
- Das Internet ist die wahrscheinlichste Quelle, in der die Schweizer Bevölkerung auf inkorrekte wissenschaftsbezogene Inhalte stösst.

KAPITEL 6 → Empfehlungen für Wissenschaftskommunikation und gesellschaftliches Engagement mit Wissenschaft in der Schweiz

- Wissenschaftskommunikation sollte ein akzeptierter Teil der Wissenschaft sein und aufgewertet werden. Wissenschaftler:innen sollten entsprechend geschult und bei Bedarf sozial, psychologisch und juristisch unterstützt werden.
- Wissenschaftskommunikation sollte dialogisch stattfinden. Wissenschaftler:innen sollten die Perspektiven der Öffentlichkeit verstehen.
- Wissenschaftskommunikation sollte die spezifischen Werte der Wissenschaft, wie Kritik und intellektuelle Offenheit, zum Ausdruck bringen und die Vielfalt der Wissenschaft widerspiegeln.
- Forschung zu Wissenschaftskommunikation sollte gefördert und in evidenzbasierte Wissenschaftskommunikation umgesetzt werden.
- Die Kommunikation zwischen Wissenschaft und Politik muss gestärkt und institutionalisiert werden.
- Wissenschaftsjournalismus sollte gestärkt werden – im öffentlichen Rundfunk, in traditionellen Medienhäusern sowie bei freien Journalist:innen.
- Eine neue Infrastruktur zur Förderung des Wissenschaftsjournalismus in der Schweiz ist notwendig.

Während der Bericht eine grosse Zahl wissenschaftlicher Arbeiten zusammenstellt, zeigt er auch zahlreiche Lücken und Verzerrungen in der Forschung zu Wissenschaftskommunikation in der Schweiz auf. Umfassende Bewertungen der Wissenschaftskommunikation und gesellschaftlichen Engagements mit Wissenschaft in der Schweiz sowie Trendanalysen, die Veränderungen im Zeitverlauf nachzeichnen, fehlen weitgehend. Diese Lücken sollten künftig geschlossen werden.

Synthèse

Contexte : La communication scientifique et le dialogue entre le public et la science se sont révélés nécessaires à maintes reprises ces dernières années, notamment lors de la pandémie de COVID-19. Ces thématiques sont importantes car de nombreuses décisions individuelles, organisationnelles et sociétales reposent sur l'expertise scientifique, mais également parce que la science et la recherche dépendent de l'acceptation du public et de la légitimation sociétale. Toutefois, en Suisse, il n'existe encore aucune évaluation approfondie de la communication scientifique et du dialogue entre le public et la science.

Mandat du groupe d'expert·e·s : Les Académies suisses des sciences ont confié un double mandat au groupe d'expert·e·s « Communicating Sciences and Arts in Times of Digital Media » : il a d'abord été chargé d'évaluer le statu quo de la communication scientifique et du dialogue entre le public et la science en Suisse, de manière générale et systématique. Ensuite, le groupe d'expert·e·s a également été mandaté pour identifier les améliorations potentielles ainsi que les recommandations concernant la manière de réaliser ces améliorations. Aussi bien l'évaluation du statu quo que les recommandations font parties de ce rapport.

Méthode : Le rapport est basé sur un examen approfondi des études interdisciplinaires disponibles analysant la communication scientifique et le dialogue entre le public et la science en Suisse. Lorsque peu de travaux académiques publiés sont disponibles ou qu'il n'y en a pas, le rapport inclut également, de manière sélective, des données originales, des résultats internationaux ainsi que des analyses secondaires. Avant la publication, une première version du rapport a fait l'objet d'une évaluation externe par le biais d'un examen public des chapitres prépubliés sur la plate-forme « Open Science Framework ». Une deuxième version du rapport a été envoyée pour révision à quatre expert·e·s de renommée internationale possédant une expérience dans la communication scientifique et le dialogue entre le public et la science et connaissant bien le contexte suisse.

Résultats : Dans l'ensemble, le rapport aborde un large éventail de thématiques liées à la communication scientifique et au dialogue avec le public en Suisse, des attitudes du public envers la science à la représentation de la science dans l'actualité et les réseaux sociaux, en passant par la communication scientifique au niveau individuel et organisationnel ainsi qu'aux différentes formes que prend le dialogue.

CHAPITRE 1 → Façon dont la population suisse perçoit la science et sources d'information et de contact en lien avec la science

- La population suisse associe principalement la « science et la recherche » avec la médecine et les disciplines MINT.
- La population suisse perçoit la science de manière positive. La confiance accordée à la science et aux scientifiques est élevée et semble rester stable.
- La plupart des résident·e·s suisses ont des connaissances scientifiques et sont en mesure de comprendre un contenu scientifique.
- La population suisse s'attend à ce que les scientifiques communiquent avec le public.
- Cependant, alors que les attitudes du public envers la science sont généralement favorables, les perceptions varient en fonction des sujets scientifique et des différents groupes de la population.
- La population suisse est régulièrement exposée à la science dans son quotidien et par le biais d'un large éventail de médias, le plus souvent en ligne.

CHAPITRE 2 → Communication scientifique : du niveau individuel au niveau organisationnel. Qui communique avec le public suisse ?

- La plupart des scientifiques pensent qu'il est nécessaire et utile de communiquer avec le public.
- Les efforts de la part des scientifiques en matière de communication et de dialogue ne correspondent toutefois pas à cette vision positive de la communication scientifique.
- Les facteurs sociétaux et organisationnels influencent la manière dont les scientifiques communiquent et échangent avec le public.
- Des différences notoires dans la façon de communiquer et d'échanger avec le public existent entre les spécialistes en fonction de leur discipline, de leur ancienneté et de leur genre.
- Au cours des dernières années, les établissements d'enseignement supérieur et les organisations scientifiques se sont concentrés sur la communication au public tout en cherchant à la professionnaliser et à la développer.
- Il existe également de nombreux autres vecteurs de la communication scientifique, à l'instar des musées, des centres scientifiques et de divers autres intervenant·e·s, par exemple au niveau politique ou des entreprises.
- Sur les réseaux sociaux, peu d'influenceurs·ceuses suisses se concentrent sur la science.

CHAPITRE 3 → Journalisme scientifique en Suisse

- Les sujets scientifiques sont couverts par des journalistes issu·e·s de différents milieux et qui contribuent donc au journalisme scientifique.
- La plupart des journalistes spécialisé·e·s dans la science cherchent à fournir des informations et une orientation objectives et n'ont pas nécessairement pour but de défendre la science.
- Le journalisme scientifique fait face à d'importants défis en lien avec les changements du secteur médiatique suisse ; le journalisme scientifique spécialisé est en train de disparaître. Il existe une centaine de journalistes scientifiques spécialisé·e·s dans le pays, et seules quelques maisons de presse comprennent une division scientifique. Les journalistes scientifiques travaillent dans des conditions de plus en plus difficiles.
- Actuellement, de nouveaux modèles de journalisme scientifique sont à l'essai en Suisse. Ils visent à donner un équilibre entre l'indépendance éditoriale, une qualité élevée et la viabilité économique.

CHAPITRE 4 → Plateformes numériques : le rôle de Google, Facebook et autres

- En ligne et sur les réseaux sociaux, on trouve beaucoup de contenu scientifique de qualité très variable.
- Les plateformes numériques ont pris de l'importance et sont très utilisées, mais elles représentent également des sources d'information moins fiables.
- Pour les jeunes, les réseaux sociaux et tout particulièrement YouTube sont des sources d'information importantes en matière de contenu scientifique.
- L'architecture des plateformes influence la perception et les actions des utilisateurs, ce qui peut parfois avoir des conséquences négatives sur la communication scientifique.
- Bien que les plateformes numériques ouvrent la voie à la désinformation et

aux fake news, elles offrent toutefois des opportunités remarquables pour la communication scientifique, par exemple en ce qui concerne la mobilisation pour des manifestations.

CHAPITRE 5 → Façon dont la science est présentée au public et débattue en Suisse

- Différents supports de communication participative et dialogique sont offerts au public suisse.
- Au cours des dernières décennies, la couverture médiatique des thématiques scientifiques a pris de l'ampleur en Suisse. Les sujets scientifiques représentent entre 1 et 3 % de l'actualité suisse.
- Les expert·e·s, les thématiques et les disciplines liées aux arts et aux sciences sociales sont très présent·e·s dans les médias suisses.
- L'actualité se focalise sur quelques scientifiques en particulier.
- Les médias traitant de sujets scientifiques semblent fournir des informations plutôt exactes, mais ils sont susceptibles d'être partiaux et peuvent être influencés par les relations publiques des organisations.
- Internet est la principale source de contenu scientifique inexact en Suisse.

CHAPITRE 6 → Recommandations en matière de communication scientifique et de dialogue entre le public et la science en Suisse

- La communication scientifique devrait être reconnue comme faisant partie de la science, et être valorisée en conséquence. Si nécessaire, les expert·e·s devraient pouvoir recevoir une formation dans ce domaine ainsi qu'un soutien social, psychologique et juridique.
- La communication scientifique devrait, dans la mesure du possible, être dialogique. Les expert·e·s devraient être à même de comprendre le point de vue du public.
- La recherche dans le domaine de la communication scientifique devrait être encouragée et appliquée de manière concrète.
- La communication entre la science et la politique doit être renforcée et institutionnalisée.
- Le journalisme scientifique doit être renforcé aussi bien auprès du public que des entreprises médiatiques traditionnelles et des journalistes indépendant· e· s.
- Afin de soutenir le journalisme scientifique en Suisse, il est nécessaire de mettre en place une infrastructure de financement.

Bien que le rapport fait état de très vastes connaissances sur ces thématiques en Suisse, il met également en évidence les lacunes et les partis pris au sein de la recherche existante. Des évaluations plus larges et complètes de la communication scientifique et du dialogue entre le public et la science en Suisse, ainsi que des analyses de tendances permettant de suivre les changements potentiels dans le temps, font grandement défaut. Les futures recherches relatives à la communication scientifique et au dialogue entre le public et la science en Suisse devraient permettre de combler ces lacunes.

Sintesi

Contesto: la comunicazione della scienza e il public engagement nella scienza sono stati ripetutamente invocati negli ultimi anni, in particolare durante la pandemia di COVID-19. Il loro ruolo è importante in quanto la competenza scientifica svolge una funzione rilevante per l'adozione di molte decisioni da parte di individui, organizzazioni e società. Inoltre, la scienza e la ricerca dipendono dall'accettazione e dalla legittimazione da parte della società. Tuttavia, in Svizzera non esiste ancora una valutazione completa della comunicazione della scienza e del public engagement nella scienza.

Mandato del gruppo di esperte ed esperti: le Accademie svizzere delle scienze hanno istituito il gruppo di esperte ed esperti «Communicating Sciences and Arts in Times of Digital Media» affidandogli un duplice mandato: *effettuare una valutazione sistematica ad ampio raggio dello stato della comunicazione della scienza e del public engagement nella scienza in Svizzera, nonché identificare possibili miglioramenti ed elaborare raccomandazioni per la loro realizzazione.* La valutazione e le raccomandazioni sono oggetto del presente rapporto.

Metodo: il rapporto si basa su una revisione a tutto campo degli studi interdisciplinari disponibili che analizzano la comunicazione della scienza e il public engagement in Svizzera. In determinati casi, il documento include anche dati originali, risultati di ricerche internazionali e analisi secondarie nei casi in cui le opere accademiche pubblicate siano scarse o inesistenti. Una prima bozza del documento è stata valutata pubblicamente mediante capitoli in preprint depositati nel repository «Open Science Framework». Una seconda bozza è stata esaminata nell'ambito di una peer review da quattro studiosi di fama internazionale con competenze rilevanti e una conoscenza approfondita della situazione svizzera.

Risultati: nel complesso, il rapporto copre una serie di aspetti della comunicazione della scienza e del public engagement nella scienza in Svizzera, dagli atteggiamenti del pubblico verso la scienza, agli individui e alle organizzazioni che si occupano di comunicazione scientifica e forme di engagement, alle notizie e alle rappresentazioni della scienza nei social media.

CAPITOLO 1 → Percezioni della popolazione svizzera riguardo alla scienza e fonti di informazione e contatto con la scienza

- La popolazione svizzera associa «scienza e ricerca» soprattutto alla medicina e alle discipline STEM.
- La popolazione svizzera ha una percezione positiva della scienza. La fiducia nella scienza e negli scienziati in Svizzera è elevata e appare stabile nel tempo.
- La maggior parte dei residenti in Svizzera è informata sulla scienza ed è in grado di comprendere i contenuti scientifici.
- La popolazione svizzera si aspetta che gli scienziati effettuino attività di comunicazione con il pubblico.
- Tuttavia, mentre il pubblico ha generalmente un atteggiamento favorevole verso la scienza, le percezioni variano a seconda degli argomenti scientifici e dei sottogruppi della popolazione.
- Nel corso della vita, la popolazione svizzera ha regolarmente contatti con la scienza attraverso un'ampia gamma di media, soprattutto Internet.

CAPITOLO 2 → Dai comunicatori scientifici individuali a quelli associati a organizzazioni: chi comunica con il pubblico svizzero?

- La maggior parte degli scienziati pensa che sia necessario e utile comunicare con il pubblico.

- Gli sforzi effettivi di comunicazione e impegno degli scienziati non coincidono però con queste opinioni positive verso la comunicazione scientifica.
- Fattori sociali e organizzativi influenzano la comunicazione e il public engagement degli scienziati.
- Esistono chiare differenze nell'impegno pubblico tra gli studiosi in base alla disciplina, all'età e al genere.
- Le scuole universitarie e le organizzazioni scientifiche hanno fortemente promosso, professionalizzato e ampliato i loro sforzi di comunicazione pubblica negli ultimi anni.
- Un ampio gruppo di altri attori (musei, centri scientifici, politici, aziende e altri stakeholder) comunica su argomenti di natura scientifica.
- Sui social media, sono pochi gli influencer svizzeri che si occupano di scienza.

CAPITOLO 3 → Il giornalismo scientifico in Svizzera

- Gli argomenti di natura scientifica sono trattati da giornalisti di diversi ambiti e background, i quali forniscono un contributo al giornalismo scientifico.
- La maggior parte dei giornalisti scientifici specializzati mira a fornire informazioni e orientamenti oggettivi e non si pone principalmente come difensore della scienza.
- Il giornalismo scientifico sta affrontando sfide significative nel mutevole ecosistema mediatico in Svizzera. Il giornalismo scientifico specializzato è in declino: sono solo un centinaio i giornalisti scientifici specializzati nel paese e soltanto un piccolo numero di testate mediatiche ha redazioni scientifiche. I giornalisti scientifici lavorano in condizioni sempre più difficili.
- Attualmente, in Svizzera si stanno sperimentando nuovi modelli di giornalismo scientifico, con l'obiettivo di conciliare l'indipendenza editoriale e l'elevata qualità con la sostenibilità economica.

CAPITOLO 4 → Piattaforme digitali: il ruolo di Google, Facebook e simili

- Un ampio volume di contenuti scientifici di qualità estremamente variabile è disponibile online e sui social media.
- Le piattaforme digitali hanno acquisito importanza e sono largamente utilizzate ma, per molti, sono diventate anche fonti meno affidabili di informazioni sulla scienza.
- Per i più giovani, i social media, e in particolare YouTube, sono fonti importanti di contenuti relativi alla scienza.
- Le architetture delle piattaforme influenzano le percezioni e le azioni degli utenti, talvolta con conseguenze indesiderate per la comunicazione scientifica.
- Le piattaforme digitali facilitano la disinformazione e la misinformazione su argomenti scientifici ma offrono al contempo notevoli opportunità per la comunicazione scientifica, ad esempio per la mobilitazione dei movimenti.

CAPITOLO 5 → Modalità di presentazione e dibattito pubblico sulla scienza in Svizzera

- Il pubblico svizzero ha a disposizione una serie di formati di comunicazione scientifica basati sulla partecipazione e sul dialogo.
- In Svizzera, la quota di copertura mediatica su notizie legate alla scienza è aumentata negli ultimi decenni e i temi relativi alla scienza rappresentano l'1-3%.
- Studiosi, temi e discipline delle scienze umane e sociali sono in primo piano nei media svizzeri.

- La copertura mediatica si concentra fortemente su un piccolo numero di scienziati.
- Le informazioni su temi scientifici pubblicate sui media appaiono per lo più accurate ma possono essere soggette a inquadrature tendenziose e all'influenza delle PR aziendali.
- Internet è la fonte più probabile tramite la quale la popolazione svizzera viene a contatto con contenuti scientifici inaccurati.

CAPITOLO 6 → Raccomandazioni per la comunicazione della scienza e il public engagement nella scienza in Svizzera

- La comunicazione della scienza dovrebbe essere accettata come parte integrante della scienza e valorizzata di conseguenza. Agli studiosi dovrebbero essere offerti formazione e sostegno sociale, psicologico e legale, ove necessario.
- La comunicazione dovrebbe essere basata sul dialogo, ove possibile. Gli studiosi dovrebbero capire il punto di vista del pubblico.
- La ricerca sulla comunicazione della scienza dovrebbe essere promossa e tradotta in una comunicazione scientifica basata sull'evidenza.
- La comunicazione tra scienza e politica deve essere rafforzata e istituzionalizzata.
- Il giornalismo scientifico deve essere rafforzato – nelle emittenti pubbliche, nelle testate mediatiche tradizionali e tra i giornalisti freelancer.
- Serve un'infrastruttura di finanziamento dell'informazione a supporto del giornalismo scientifico in Svizzera.

Il rapporto ha compilato una quantità considerevole di studi scientifici, evidenziando al contempo numerose lacune e distorsioni nella ricerca sulla comunicazione della scienza in Svizzera. Mancano valutazioni più ampie e complete della comunicazione scientifica e del public engagement nella scienza in Svizzera, così come analisi delle tendenze nell'ambito di un monitoraggio dei cambiamenti nel tempo. In futuro, la ricerca sulla comunicazione della scienza e il public engagement in Svizzera dovrebbe rimediare a queste lacune.

Table of Content

I. Introduction

The ongoing COVID-19 pandemic illustrates both the importance and the variety of interactions between science and society. It has seen individual scientists as well as national and regional advisory bodies like the Swiss National COVID-19 Science Task Force communicate research results to the public, comment on the current situation and future developments, assess potential counter-measures, and engage in discussions with decision-makers.

COVID-19 also demonstrated the considerable societal demand for information about the pandemic. Decision-makers and stakeholders repeatedly called for reliable scientific assessments of the situation, and many Swiss citizens turned to news media and social media regularly and intensively (Friemel, Geber & Egli, 2020; Rauchfleisch, Vogler & Eisenegger, 2020).

Correspondingly, news media coverage and social media communication rose dramatically. Between March and May of 2020, almost 70% of news media reports published in all linguistic regions of Switzerland touched upon the pandemic, mostly on epidemiological, virological and public health information, on the pandemic's societal and economic implications and on (potential) political countermeasures (fög, 2020b, 7ff.). It was flanked by an enormous amount of information online and in social media (World Health Organization, 2020).

The pandemic also demonstrated, however, that science, scientific expertise and recommendations were perceived differently by members of the Swiss public. While studies showed a pronounced trust in science and regulatory measures during the pandemic, particularly in its early phase (gfs.bern, 2020; Science Barometer Switzerland, 2020; SRG SSR, 2020), they also indicated that this support decreased over time (SRG SSR, 2020), and that measures were met with skepticism and opposition in some segments of the population from the outset (Friemel et al., 2020; Rauchfleisch et al., 2020; Science Barometer Switzerland, 2020).

I.I Relevance and Aim of this Report

The COVID-19 pandemic is the most recent, and certainly one of the most pressing, examples for the importance of science communication and of public engagement with science. But such interactions have taken place around other issues as well in Switzerland, which has been described as a country with strong public involvement in "science and technology decision-making" and an "emerging" science communication culture (Mejlgaard, Bloch, Degn, Nielsen & Ravn, 2012). In recent decades, starting with a 1998 referendum on gene technology (Bonfadelli, 1999), a large number of scientific or science-related issues have been debated in the Swiss public, such as environmental pollution (Eisner, Moser & Graf, 2000), climate change (Bonfadelli, 2017a), nuclear energy (Kristiansen, 2017), biotechnology

(Bonfadelli & Dahinden, 2002), animal experimentation (Crettaz von Roten, 2009) or personalized medicine (Schweizer Akademien der Wissenschaften, 2020).

Monitoring these science-society interactions and their development is important – due to their described relevance, but also given the profound changes in the socio-political and socio-cultural conditions shaping these interactions in other countries (e.g., Fischhoff & Scheufele, 2013).

Scholars have described, for example, that science communication and public engagement has become more common among scholars and scientific organizations (e.g., Peters, 2013; Serong et al., 2017), and that more, and more diverse, stakeholders communicate about science-related issues nowadays (e.g., Bubela et al., 2009). Partly, this is due to digital and social media providing novel interfaces between science and society (Dickel & Franzen, 2015). They enable individuals and organizations – from scientific organizations over politicians, corporate representatives, think tanks and NGOs to individual citizens – to produce original content and to distribute it widely, circumventing journalistic gatekeepers (e.g., Neuberger, 2014). It has also been described as the result of changing incentives within science: Scientists and scientific organizations are increasingly asked to be more transparent (e.g., Strasser, 2019, 263ff.), to legitimate themselves towards society, and document their societal impact as part of a new "third mission" that is now added to research and teaching, and that focuses more strongly on the public and on societal outreach and impact (e.g., Laredo, 2007).

In addition, the surrounding media ecosystem is changing (for an overview see Schäfer, 2017b). Many news media experience an economic crisis, with subscription and advertisement revenue shrinking – in large part because platforms like Google, Facebook, YouTube or Twitter now curate large amounts of communication, steer audience attention and siphon off advertisement revenue (e.g., Helmond, 2015). This affects specialized journalism like science reporting the hardest (e.g., Allan, 2011; Brumfiel, 2009), with media houses in many countries downsizing or closing science desks because they are seen as expensive and as attracting smaller audiences than other desks (Dunwoody, 2014; Schäfer, 2017a).

Correspondingly, the communication patterns and media use of audiences are changing, with online sources becoming more important also regarding information about science (Brossard, 2013; Scheufele, 2018). At the same time, it is "becoming more difficult for many citizens to evaluate the credibility and accuracy of content they encounter", even if they intend to do so, "because its sources can be opaque, and because it comes with new contextual cues like likes or user comments that influence credibility assessments" (Schäfer, 2017a, p. 56). Numerous scientists, scientific organizations, science policymakers and stakeholders assume that these changes lead to a loss of societal support for science, diagnosing an age of mis- or disinformation, of "post-truth" and "alternative facts" (e.g., ALLEA, 2018, 2019a; 2021).

To adequately assess these changes and their implications, it is necessary to systematically monitor the status quo and current developments in science communication and public engagement with science. Such assessments exist in many countries, sometimes coupled with explicit recommendations. In the US, examples are the working groups, Sackler Colloquia and reports of the National Academies of Science, Engineering and Medicine as well as the science communication initiatives of the American Association for the Advancement of Science (Fischhoff & Scheufele, 2013). In the UK, the Royal Society has focused on science-society interactions for decades in working groups and reports, and bodies like the Royal Academy of Engineering have taken up the issue as well (e.g., Royal Society, 2006). In Germany, several scientific academies – such as acatech, the Berlin-Brandenburg Academy of Science and Humanities (BBAW) or the Leopoldina – support interdisciplinary working groups and reports on the issue (e.g., Union of the German Academies of Sciences and Humanities, 2017). Similar initiatives exist in Ireland (e.g., Murphy, 2020), China (e.g., Lin & Honglin, 2020), other countries and on the European level (ALLEA, 2018, 2019a, 2019b).

But such an assessment does not yet exist in Switzerland. Therefore, the Swiss Academies of Arts and Sciences has set up the expert group "Communicating Sciences and Arts in Times of Digital Media" (for information about its composition see the appendix of this report) in 2019 with a twofold mandate:

1. First, the expert group was mandated to *assess the status quo of science communication and public communication in Switzerland broadly and systematically,* characterizing the specifics of the Swiss situation, drawing on scholarly work and expert assessments to provide an overview over the current situation in the country and judging the applicability of findings from similar initiatives in other countries. CHAPTERS 1 TO 5 of the report at hand are the result of this first step and provide such an overview.
2. Second, the expert group was mandated to *identify potential improvements as well as recommendations for how to realize those improvements,* addressing science and scientific institutions itself, but also relevant stakeholders in politics and society. These recommendations are presented in CHAPTER 6.

I.II The Swiss Case

Switzerland offers favorable structural, political and sociocultural conditions for science and research (for an overview see State Secretariat for Education, Research and Innovation, 2020). It offers a high degree of academic freedom, an international scientific staff, high federal and private sector investment in science as well as a wide range of public and philanthropic funding opportunities for researchers with high funding rates. For a small country, it hosts a considerable number of Higher Education Institutions, such as the globally renowned Swiss Institutes of Technology

in Zurich (ETH Zürich) and Lausanne (EPFL), highly-ranked research universities like those in Basel, Berne, Geneva, Lausanne or Zurich, as well as a range of other universities, universities of applied sciences, universities of teacher education, and universities of the arts (swissuniversities, 2018). In addition, the country hosts large research centers of global, national and regional importance, like the European Organization for Nuclear Research (CERN), the Swiss Federal Laboratories for Materials Testing and Research (EMPA) or the Swiss Centre of Expertise in the Social Sciences (FORS). These favorable conditions translate into a strong research output, with Switzerland leading the world in publications per capita, having a high number of patents and being considered one of the most innovative countries in the world (State Secretariat for Education, Research and Innovation, 2020, p. 20).

In Switzerland, science communication and public engagement with science are called for due to several reasons: The country is described as a knowledge society lacking natural resources and, thus, being dependent on a well-educated workforce. Switzerland's political system contains strong elements of direct democracy, allowing for regular referenda on national, cantonal and local levels, including on science-related issues like reproductive medicine or stem cell research (Mejlgaard et al., 2012; swissvotes, 2020). This opportunity for public referenda, it is argued, necessitates an informed citizenry (cf. State Secretariat for Education, Research and Innovation, 2017). In addition, scientific and higher education institutions use communication to legitimize the public funding they receive and to position themselves favorably in competition with other organizations (Hafner, 2020, 120ff.).

Conditions for science communication and public engagement with science are also advantageous compared to many other countries (Mejlgaard et al., 2012). Switzerland has a varied funding landscape: The Swiss National Science Foundation (SNSF) invests more than 9 million CHF annually in science communication (SNSF, 2020a), e.g., via its Agora funding scheme, where researchers can apply for communication and engagement projects and more than 130 projects have been funded so far. The Swiss Innovation Agency Innosuisse has funded "Knowledge and Technology Transfer" projects with more than 6 million CHF in 2018. The Swiss Academies of the Arts and Sciences have funded projects and workshops on science communication and engagement (e.g., Akademien der Wissenschaften Schweiz, 2009; Hafner, 2020), and the Federal Offices of the national government have funded research on their communication campaigns as well (e.g., Poggiolini, Wirth, & Scholz, 2018). In addition, Switzerland hosts a highly developed ecosystem of private and public foundations (SwissFoundations, 2020), several of which are involved in funding science communication and public engagement with science. Foundations like the Gebert Rüf Foundation and the Mercator Schweiz Foundation have or had funding lines on issues like "scientainment". Furthermore, crowdfunding initiatives were successful in Switzerland as well. On the platform "wemakeit.com", the science-focused "ScienceBooster" channel has funded science communication projects, such as the science journalism project "Higgs" which received more than 100.000 CHF in crowd donations.

In addition, Switzerland has a strong communication ecosystem: Public service broadcasting is well established in all linguistic regions. Newspapers are widely read and based on a pluralistic national, regional and local press (Künzler, 2013), which is, however, in rapid decline currently (EMEK, 2020). Almost the entire population has access to and regularly uses the internet (Latzer, Büchi & Festic, 2019b).

I.III Broad Understanding of Science Communication and Public Engagement with Science

In focusing on science communication and public engagement with science in Switzerland, the expert group employs a broad understanding of its object, interpreting it as all forms of communication and engagement between science and society (Bonfadelli, Fähnrich et al., 2017; Bucchi & Trench, 2014; Schäfer, Kristiansen & Bonfadelli, 2015). This understanding is broad in several ways:

- First, it incorporates *communication and engagement about the full disciplinary spectrum*. This includes the natural sciences or "STEM" (science, technology, engineering and mathematics) disciplines as well as the humanities, social sciences and arts.
- Second, it includes *different modes of communication and engagement* (for overviews see Akin & Scheufele, 2017; Schäfer & Metag, 2021). This incorporates one-directional public communication from science, i.e., efforts by scientists and scientific organizations to disseminate knowledge in order to educate non-scientists, as conceptualized by "deficit model" or "public understanding of science" models. It also includes two-way, dialogical exchanges between science and non-scientists as well as stakeholders, as conceptualized by "public engagement with science and technology", "dialogue" or "science on the marketplace" models (Dahinden, 2004). And it includes communication about science from, or between, non-scientific individuals and organizations, including representatives or politics, the economy, civil society, etc., as modelled by "science in context" or "conversation" models.
- Third, it incorporates *multiple forms and channels of communication and engagement* (for an overview see Bucchi & Trench, 2020). This includes scholars' engagement in schools and public lectures, science education in museums and science centers, outreach and PR activities of scientific and higher education institutions, as well as science journalism and online or social media communication.[1]

[1] With its focus on public science communication and public engagement with science – and because other initiatives by the Swiss Academies of Arts and Sciences (2019) specifically address this field already – the report does not focus on scholarly communication, i.e. on communication within science – even though the delineation between 'internal' and 'external' communication has become more hybrid recently due to changes in the media ecosystem (Neuberger, 2014). Scholarly communication will be taken up, however, where it is relevant for, or touches upon, public science communication and engagement. The same is true for science communication and public engagement activities in other countries, e.g., via external science policy, 'science diplomacy' or organizations like Swissnex (for an overview see van Langenhove, 2017, 22f.).

I.IV How the Report was Compiled as well as Publicly and Peer Reviewed

The status quo report is based on a variety of sources compiled by the expert group: This included a comprehensive review of the available scholarly literature analyzing science communication and public engagement with science in Switzerland, i.e., an assessment of scholarship from communication science, education science, political science, sociology and interdisciplinary fields like science and technology studies. Additionally, the report incorporated original data and selected secondary analyses for aspects on which little or no published scholarly work was available. The selection and interpretation of these materials rested on the expertise assembled in the expert group itself, systematic database searches, as well as on additional interviews and discussions with external experts (see appendix for an overview).

After a draft version of the report was compiled, it was externally evaluated via pre-publication public and peer review. First, when a draft version of each individual chapter of the report was available, a preprint of the respective draft chapter was uploaded to the "Open Science Framework" repository, and more than 120 experts and stakeholder organizations from Switzerland and beyond were invited to give feedback. During the 4-months process of this pre-publication public review, the preprint chapters were downloaded more than 270 times, resulting in over 100 comments that were submitted to the expert group and incorporated into the report.

Second, the report was sent out for pre-publication peer review to two Swiss and two international scholars – all with expertise in science communication and public engagement as well as with familiarity with the Swiss situation: Prof. em. Dr. Heinz Bonfadelli (University of Zurich), Prof. Dr. Fabienne Crettaz-von Roten (University of Lausanne), Prof. Dr. Adrian Rauchfleisch (National University of Taiwan) and Prof. Dr. Hannah Schmidt-Petri (University of Passau, Germany). Their feedback was incorporated into the report as well.

I.V Plan of the Report

The resulting, consolidated report provides an overview of the status quo of science communication and public engagement with science in Switzerland. The report's scope ranges from the Swiss public's attitudes towards science over the role of communicators and mediators around science-related issues to news media and social media representations of science in Switzerland. This assessment of the status quo of science communication and public engagement is organized in five chapters following this introduction (Figure 1)[2]:

[2] In all chapters, scholarship on science communication and public engagement during the COVID-19 pandemic is woven in, where available.

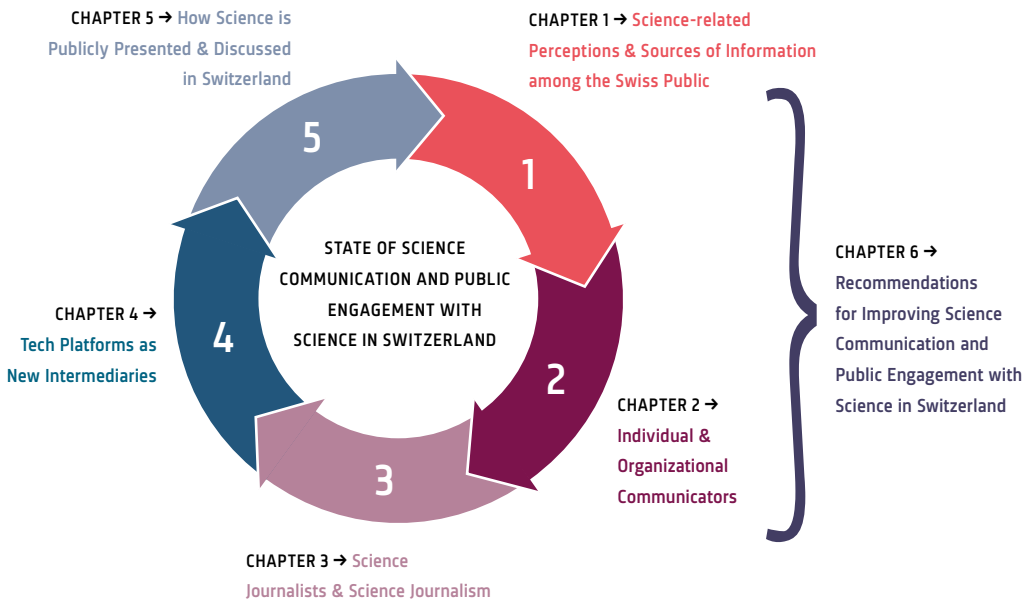

Figure 1: Structure and Chapters of the Report

- CHAPTER 1 presents the Swiss citizens' perceptions of and attitudes towards science, for example what is known about public trust in science or how different segments of the Swiss population differ in their views about science. The chapter also surveys scholarship on the Swiss' sources of information about science related issues, and lays out how important news media sources are, for example vis-à-vis social media and messengers, museums and science centers, or interpersonal communication.
- CHAPTER 2 portrays the activities of individual and organizational science communicators, both within and beyond institutionalized science. It illuminates to what extent individual scientists are involved in public communication and engagement activities, and summarizes findings about the communication and engagement efforts of scientific and higher education institutions, but also museums, science centers, etc.
- CHAPTER 3 describes the situation of science journalism in Switzerland. It assesses the role of science journalism in Swiss media houses, the working conditions of individual science journalists and current developments that have caused considerable changes in domestic science journalism.
- CHAPTER 4 assesses the role of technological platforms as new intermediaries of science communication and public engagement with science. While it highlights their importance, it also demonstrates that little is known about their role with regards to science-related issues, specifically in Switzerland.

- **CHAPTER 5** presents how science and science-related topics are portrayed publicly in Switzerland, i.e., in Swiss news media, online and in social media. It describes which fields and topics of science are portrayed most often, in what ways, and how accurate these portrayals are from a scientific standpoint.

The order of these chapters could have been different – especially as the emergence of digital media has lowered the thresholds for feedback loops between members of the public and scientists or professional communicators. The expert group chose to start with the chapter on public perceptions and attitudes towards science to signal its understanding of the role of science communication and public engagement with science – which should serve society, improve its capacity to understand and engage with science, learn from it, criticize it where necessary and ultimately, make better decisions.

After presenting the status quo of science communication and public engagement with science in Switzerland in these five chapters, **CHAPTER 6** contains the expert group's recommendations for action. Similar to the status quo assessment, they focus on the role of individual scientists, on institutional science communication, on science journalism, science-policy interfaces and other aspects. They address stakeholders and decision-makers from science and higher education over funding organizations to politicians and media houses. The expert group is convinced that realizing these recommendations would strongly benefit science communication and public engagement with science in Switzerland.

1 Science-related Perceptions of the Swiss Population and their Sources of Information and Contact with Science

How does the Swiss population see science, what are its attitudes towards it, and where does it come in contact with science? These questions are important for science communication and engagement initiatives which ultimately aim at reaching, communicating to and engaging with the broader public. Therefore, an assessment of public perceptions of science – their interest in, knowledge about and trust towards science – is important. Equally important is an assessment of the situations and sources through which the public comes into contact with science-related issues. The scholarly evidence on these questions that is available for Switzerland will be presented in the following chapter.

1.1 Public Perceptions of Science in Switzerland: Knowledge, Interest, and Trust

People's interest in, attitudes towards, trust in, and knowledge of science have been analyzed extensively by social scientists internationally – and partly also for Switzerland. In doing so, scholars have often subsumed these factors as 'public perceptions' of science (e.g., Besley, 2013 for an overview).

WHAT IS THE EVIDENCE BASE FOR THESE QUESTIONS IN SWITZERLAND?

Amount of data	Quality of data	Published analyses
• considerable body of data available • mostly quantitative surveys • thematically mostly focused on "science" in general or STEM topics • little qualitative work	• high-quality quantitative survey data (standardised, representative) for public perceptions of science in general • similar data on specific research fields or issues also available	• limited amount of scholarly analyses available for Switzerland • some areas well-researched, but considerable desiderata

A considerable body of robust quantitative data is available to assess public perceptions of science in Switzerland. This is particularly true for perceptions of science in general, which are assessed via representative, national population surveys such as the Eurobarometer (2001, 2005, 2010b), the World Value Survey 2007 (Inglehart et al., 2014), the Wellcome Global Monitor 2018 (Gallup, 2019), and the tri-annual Science Barometer Switzerland (2016, 2019), among others. These surveys use nationally certified sampling standards and provide reliable, temporally and internationally comparable insights into people's perceptions of science. They are almost exclusively based on standardized questions, however, and limited to small periods of time.

The quantity and quality of standardized data are more varied when it comes to public perceptions of specific science-related topics. Some insights can be derived from public votes on issues like research on embryonic stem cells (Federal Chancellery, 2003), yet official numbers are limited to regional vote counts. In addition, several surveys are available on specific issues: The Science Barometer Switzerland captured support of selected disciplines and the Wellcome Global Monitor 2018 assessed attitudes towards health professionals and vaccines, including in Switzerland. Other surveys have measured attitudes towards bio- and gene technology (Bonfadelli & Meier, 2010; Eurobarometer, 2010a; NFP 59, 2013), animal experimentation (Eurobarometer, 2001, 2005), nuclear energy (Kristiansen, Bonfadelli & Kovic, 2016), environmental issues (gfs-zürich, 2018; ISSP Research Group, 2019), 5G cellular network technology (Frey, 2020; Schanne, 2003), innovation (Seidl, Wirth & Krütli, 2019), as well as adolescents' perceptions of STEM fields (Bührer et al., 2014). Continuous national surveys on issues like health and medicine and general attitudes towards technology, among others, are missing in Switzerland, and the number of published scholarly analyses is limited compared to the considerable amount of data available.

The amount of qualitative studies on the Swiss population's perceptions of science and science-related issues is also limited. Examples for exceptions are a study combining smartphone-based media diaries with qualitative interviews about peoples' perceptions of science (Koch, Saner, Schäfer, Herrmann-Giovanelli & Metag, 2019), and a number of reports by TA-SWISS on participatory events on issues like nanotechnology, embryonic stem cells or research on humans (Burri & Bellucci, 2008; TA-SWISS, 2002, 2004).

Summary of Findings on Switzerland

The Swiss population associates "science and research" mostly with medicine and STEM disciplines. When asked about their associations when hearing "science and research", the Swiss mostly think about topics like health, medicine, or the natural sciences more generally (Science Barometer Switzerland, 2016). It should be noted that this association likely underlies most of the survey findings outlined in this section.

The *Swiss population perceives science positively*. The Science Barometer Switzerland (2019) shows that Swiss residents have considerable interest (56% "high" or "very high") in science and research (and has even risen during the COVID-19 pandemic, as shown below). This interest is higher among men (63%) and people with tertiary education (66%). A majority of 73% of the Swiss population "agree" or "fully agree" that scientific research should be publicly funded and support basic research without any immediate applications. People with tertiary education hold these two views even more strongly (approx. 80%). These findings mirror those of the Science Barometer (2016). The 2016

survey also asked about people's motives for concerning themselves with science, showing they mostly do so out of curiosity (69% "agree" or "fully agree"), to increase their understanding of science (58%), and to obtain knowledge for school or work (57%). These trends are corroborated by Eurobarometer data, which show that only about 10% of the Swiss population are "not at all" (vs. "moderately" or "very") interested in "new scientific discoveries" and "new inventions and technologies" (Eurobarometer, 2005), and that 16% were "not at all" interested in new scientific discoveries and technological developments in 2010 (Eurobarometer, 2010b). This high level of interest is mirrored by 50% "fully agreeing" that they always participate in public votes if the issue is related to science and research (Science Barometer Switzerland, 2016). For the questions where international comparisons are available, they indicate that the Swiss population's perceptions of science are on par or slightly more positive compared to other European countries (Eurobarometer, 2010b; Wissenschaft im Dialog, 2019).

Most Swiss residents are knowledgeable about science and well equipped to understand science-related content. The population in Switzerland is highly educated in general. About 44% of the population have tertiary degrees, a number that rises to 54% among people aged 25 to 34 (Federal Statistical Office, 2019g). Switzerland ranks 10th in the world according to the United Nations Education Index 2018 and second regarding average years of schooling (13.4 years, United Nations Development Programme, 2018).

In addition, general knowledge about science has been measured as well. In international studies, this was done in different ways, several of which are also available for Switzerland: First, scholars have embedded quiz questions (i.e., true/false statements) about scientific facts in surveys, like "electrons are smaller than atoms – true or false?", aiming to assess "scientific literacy". The Science Barometer Switzerland (2016) used such a measure, indicating that the Swiss population, on average, answered 7.6 out of 11 quiz questions correctly. People with tertiary education (8.1 correct answers) perform significantly better than the rest of the population. The Eurobarometer (2005), using a similar quiz in several countries, ranked Switzerland clearly above the European average (71% correct answers compared to 66%) and 8th among 32 European countries.

Surveys have also investigated the Swiss' understanding of scientific principles. For example, a question asking whether "scientific theories never change" was identified as incorrect by 86% of respondents in 2019 (Science Barometer Switzerland, 2019). Additionally, surveys can focus on specific topics, like an online survey of the German-speaking Swiss population in 2018 that measured respondents' knowledge about chemistry and toxicological principles (using statements such as "both synthetic and natural chemical substances can cause cancer in humans") and showed that people answered 4 out of 8 questions cor-

rectly on average (Saleh, Bearth & Siegrist, 2019). Measures such as statistical literacy and scientific reasoning (e.g., Drummond & Fischhoff, 2017) have not yet been employed in Switzerland.

Furthermore, studies have asked respondents to self-assess their knowledge of science. The Swiss population's self-assessment is modest in this respect: 66% of the Swiss population report to know some (55%) or a lot (11%) about science, which is average compared to other countries in Western (54% and 15%) and Northern Europe (53% and 14%) (Gallup, 2019).

Another assessment of knowledge about science are standardized education tests. The Programme for International Student Assessment (PISA) regularly tests 15-year-old students' competences in reading, mathematics and natural sciences across countries. Its findings show that Swiss students display reading competences similar to the OECD average, but perform significantly better in mathematics and natural sciences (Konsortium PISA.ch, 2019).

Trust in science and scientists in Switzerland is high and seems stable over time. The Swiss display high trust in "science in general" (56% "high" or "very high"), and they also trust scientists: 64% of the population have "high" or "very high" trust in university scientists, and about 70% of the population "agree" or "fully agree" that scientists are competent and qualified. Men, people aged 15 to 34 years, and people with tertiary education have particularly high trust in these dimensions (Science Barometer Switzerland, 2019). Trust in science remained strong, and even increased, during the COVID-19 pandemic, with 80% of the Swiss population indicating that they "tend to trust" or "fully trust" science as the first Swiss lockdown came to an end at the end of April 2020 (gfs.bern, 2020), and with trust remaining above pre-pandemic levels in November 2020 (Science Barometer Switzerland, 2020). These results are also in line with Gallup's (2019) findings from 2018 showing that 91% of Swiss people trust scientists "some" (48%) or "a lot" (43%), which is markedly higher than the Swiss population's trust in journalists (67% "some" or "a lot") or the national government (81% "some" or "a lot"), and only surpassed by their trust in doctors and nurses (95% "some" or "a lot"). Trust in scientists is generally high across the world (Funk, Tyson, Kennedy & Johnson, 2020). Still, the Swiss population's trust in scientists is above average compared to 143 countries included in the Gallup survey. Switzerland ranks 18th among 40 European countries (**FIGURE 2**), and 37th among 144 countries worldwide (Gallup, 2019).

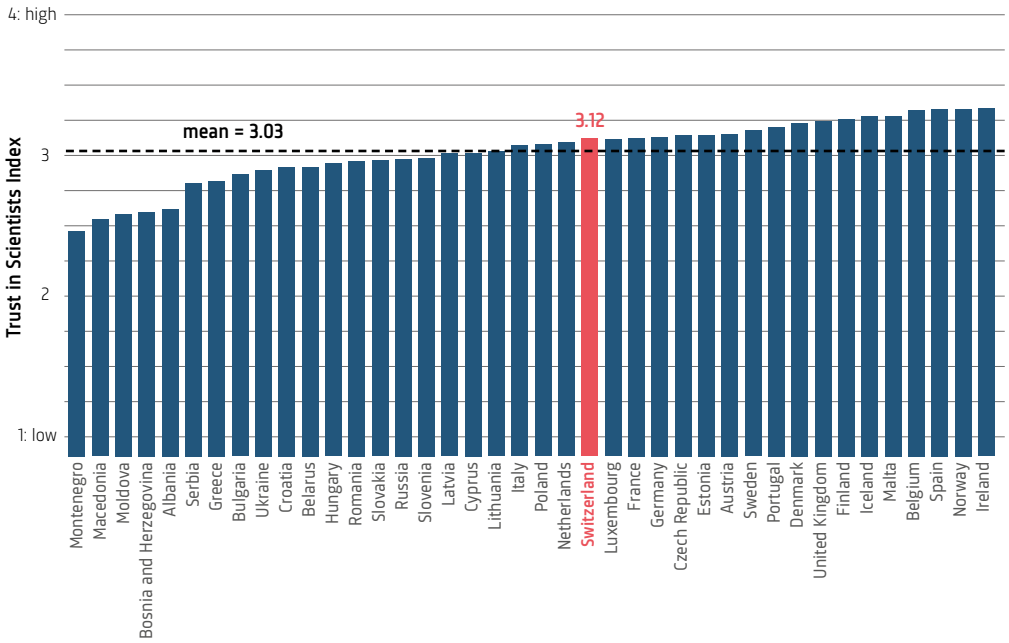

Figure 2: Index of five variables measuring trust in scientists in 40 European countries, showing the average level of trust indicated by survey respondents between 1 ="low" and 4 = "high". Switzerland ranks 18th, above average, among the surveyed countries (Gallup, 2019)

The Swiss population expects scientists to communicate to the public. The Swiss population's trust in science, in scientists and in their qualifications is accompanied by demands for science communication: 79% of the Swiss population "agree" or "fully agree" that scientists should inform the public about their work (Science Barometer Switzerland, 2019), an opinion that was less common (73%) in 2016 (Science Barometer Switzerland, 2016). 49% "agree" or "fully agree" that scientists should listen more to what common people think (Science Barometer Switzerland, 2019). Older insights from 2005 show that 50% were unsatisfied with scientists' communication, agreeing that "scientists put too little effort into informing the public about their work" (Eurobarometer, 2005).

These perceptions of science, however, need to be qualified in two ways: First, while general attitudes for science are favorable overall, perceptions vary between different scientific topics – even though the respective data have many gaps and are hard to compare comprehensively. While the majority of the Swiss population does not doubt that vaccines are effective, for example, 22% "somewhat disagree" or "strongly disagree" that vaccines are safe, making it the 5th most skeptical country across 144 countries included in the recent Gallup study (Gallup, 2019). Another example is that the Swiss population mostly opposes nuclear energy, as measured in 2013, 2014, and 2015, and slightly disagrees

that the benefits of nuclear energy outweigh its risks (Kristiansen, Bonfadelli & Kovic, 2016). This variety of attitudes can also be observed within individuals; people supporting the scientific consensus on climate change, for example, might disagree with findings on the safety of genetically modified organisms. Second, perceptions of science also differ between subgroups of the population. For example, 55-60% of people in French-speaking cantons voted for the "Nuclear Withdrawal Initiative", while 54.2% of the Swiss population voted against it (Federal Chancellery, 2016). Studies based on the Science Barometer Switzerland 2016 identified four subgroups (FIGURE 3) within the Swiss population with distinctly different attitudes towards science (Koch et al., 2019; Schäfer, Füchslin, Metag, Kristiansen & Rauchfleisch, 2018).

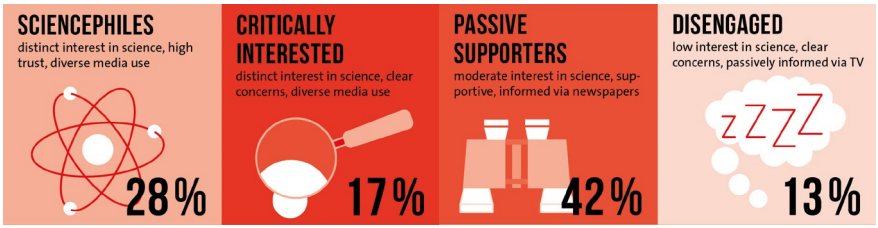

Figure 3: The four audiences of science communication in Switzerland: Swiss population segments based on 20 different attitudes towards science and research (Schäfer et al., 2018).

- The "Sciencephiles" make up about 28% of the Swiss population. People in this group have high interest in, high knowledge about and very positive perceptions towards science. They feel that science plays an important role in their lives and are highly supportive of public funding towards it. They are optimistic when it comes to science's potential and the advances it can achieve.
- The "Critically Interested" (17%) match the "Sciencephiles" in their knowledge of, positive attitudes towards and support of science funding. The main difference is that they trust science less, clearly favor research constraints in some fields and think that humanity relies too heavily on science.
- The "Passive Supporters" (42%) are the largest group. Their interest, attitudes, and trust regarding science are moderate. Overall, they share some hopes when it comes to scientific achievements and harbor some reservations regarding ethical considerations such as having clear limits on what science should be allowed to investigate. For example, they think science improves human life, but also that scientific research should have clear constraints.
- The "Disengaged" (13%) – the smallest segment – have more negative perceptions of science, albeit being not wholly negative. They are ambivalent about public funding for science, do not think it is important in their lives, do not trust science strongly, and are not interested in it. Like the "Critically Interested" they think that society relies too heavily on science and that research constraints are necessary.

COVID-19 CONTEXT: SCIENCE-RELATED PERCEPTIONS AND SOURCES OF INFORMATION

Science-related perceptions and sources of information have changed – and are still changing – during the pandemic caused by novel coronavirus (COVID-19). A large amount of data has been collected to analyze this extraordinary situation internationally, and a considerable number of research projects have also been initiated in Switzerland (see the SNSF (2020c) COVID-19 research project registry for an overview). With regards to the Swiss population's science-related perceptions and sources of information, these projects indicate a number of relevant findings and developments. It has to be noted, however, that these findings are often based on first, sometimes not peer-reviewed studies, and that they describe phenomena which are dynamic and may still change.

Public trust in science has increased considerably during the COVID-19 pandemic. A survey during the March 2020 lockdown showed the Swiss population's very high trust in the healthcare sector, in the Federal Office of Public Health and in national public broadcasters (around 4.0 to 4.2 on a 5-point scale), whereas trust in commercial radio, tv and print news sources was significantly lower, albeit still positive (around 3.3) (Friemel et al., 2020). A study at the end of the first lockdown showed that 80% of the Swiss population indicated that they "tend to trust" or "fully trust" science (gfs.bern, 2020) – a number considerably higher than approx. 55% reported by the Science Barometer Switzerland in 2016 and 2019 (Science Barometer Switzerland, 2016, 2019). In November 2020, the "COVID-19 Edition" of the Science Barometer Switzerland reiterated the finding that trust in science was higher than prior to the pandemic, albeit the increase was not as pronounced anymore, with 67% of respondents indicating to "trust" or "fully trust" science (Science Barometer Switzerland, 2020). Surveys in other countries showed that half of the UK's population reported an increasing trust in science during the pandemic (King's College London, 2020), or that the French population trusted doctors and scientists the most during the pandemic (Bono, 2020). The Science Barometer Germany showed that trust in science increased as well, from 46% in 2019 to 73% in April and 66% in May 2020 during the first German COVID-19 lockdown (Wissenschaft im Dialog, 2020).

The Swiss population expects scholars to engage in public communication and to involve themselves in political debates about the pandemic. In November 2020, the COVID-19 edition of the Science Barometer Switzerland showed that 63% of the population expected scientists to involve themselves in political debates about the pandemic, and 74% indicated that political decisions should rest on scientific evidence (Science Barometer Switzerland, 2020).

People's media and information use, and their attention to science-related and COVID-19-related news, changed and are still changing. Media use in German-speaking Switzerland increased across almost all sources during the lockdown in March and April 2020 (Kaspar, 2020). In November 2020, national levels of COVID-19-related media use were still heightened (Science Barometer Switzerland, 2020). Insights from Germany indicate that such increased media use is largely related to an increased news media consumption (Peter & Brosius, 2020). A weekly COVID-19 survey in Germany showed that around 72% were regularly informing themselves about COVID-19 around the time when the national Robert-Koch Institute updated the COVID-19 risk to "high". This attentiveness remained high during subsequent weeks and started to slowly

decrease in May 2020 (Betsch, 2020). Similar spikes in news attentiveness where observed when other countries went into lockdown (Kleis Nielsen, Fletcher, Newman, Brennen, & Howard, 2020), as were subsequent reductions of public interest and an increasing "issue-fatigue" (Kalogeropoulos, Fletcher & Kleis Nielsen, 2020).

Traditional media like television and radio have become increasingly important during the COVID-19 pandemic. A representative survey during the first days of the lockdown in March showed that the population considered national public television (4.3), national public radio (3.7) and online newspapers (3.6) as the most relevant media sources (Friemel et al., 2020). While it has been shown that the Swiss population's social media use intensified during the lockdown (Hargittai et al., 2020), social media platforms were seen as the least relevant sources, even among younger people aged 16-29 (Friemel et al., 2020; Science Barometer Switzerland, 2020). In Germany and Sweden, national-public television was also the leading source of information for most people (Betsch, 2020; Vetenskap & Allmänhet, 2020). In Argentina, Spain, South Korea and the UK, television was the second most important news source behind online and social media (Kleis Nielsen et al., 2020).

News media reporting during the COVID-19 pandemic has been perceived more critical over time. During the first days of the Swiss lockdown in March, a majority of people (approx. 56%) thought that there was too much media content on COVID-19, while 45% thought that the tonality of the content was overly dramatic (Friemel et al., 2020). A larger survey showed that 22% felt that the media coverage was exaggerating at the beginning of the lockdown, a number that increased to 30% three weeks into the lockdown (SRG SSR, 2020) and has risen further since (sotomo, 2021). This is contextualized by around 50% of respondents indicating that they feel comprehensively informed by the media (SRG SSR, 2020). Weekly data from Germany showed that about two thirds of Germans perceived media coverage on COVID-19 as out of proportion in early March, before the Robert-Koch Institute updated the COVID-19 risk to "high". Afterwards, about 47% held this sentiment throughout the pandemic (Betsch, 2020). Similar sentiments regarding allegedly alarmist media coverage were found in Sweden, where 67% found news media coverage to be alarmist at the end of March (Vetenskap & Allmänhet, 2020). It is notable that these studies did not ask about specific media types or titles, even they respondents likely thought of news content.

1.2 Contact with Science in Everyday Life, Museums, Events and Participatory Formats

The public can encounter science and science-related issues in many places (Bucchi & Trench, 2021). Many scholars have assessed how frequent and important peoples' encounters with science are: in conversations with friends and family, in museums, zoos or science centers, at science-related events such as open days and science slams, by participating in consensus conferences or in popular culture, online and news media.

WHAT IS THE EVIDENCE BASE FOR THESE QUESTIONS IN SWITZERLAND?

Amount of data	Quality of data	Published analyses
• data available for facets of the Swiss population's contact with science in everyday life • mostly quantitative surveys • focused on contact with "science" in general • little qualitative work	• high quality quantitative survey data for everyday life contact with science, but limited to respondents' self-assessments • similar data for specific issues lacking	• few published scholarly analyses available for Switzerland • reports capture amount of contacts only (and not quality) • considerable desiderata

Comprehensive data on the Swiss public's engagement with science is available, albeit for a narrow spectrum of activities. The Science Barometer Switzerland surveys ask people how often they come into contact with science through a number of everyday life situations, such as going to museums, attending science-related events, or talking about science with friends (Science Barometer Switzerland, 2016, 2019). Population surveys also measure attitudes towards forms of engagement with science (Eurobarometer, 2010b; Science Barometer Switzerland, 2016, 2019), e.g., whether respondents think that science is important in their personal lives, or whether public opinion should influence decisions about science or the research agenda. Several surveys also ascertain reported behavior such as donating for research projects, attending public meetings or signing petitions (Eurobarometer, 2005, 2010b) as well as voting on science-related issues and the intention to participate in citizen science projects (Science Barometer Switzerland, 2016, 2019). Data on actual science-related behavior is scarce. It exists, for example, for visitor numbers of Swiss (science) museums (Federal Statistical Office, 2019d) or participants in science cafés (Science et Cité, 2016). In addition, the amount of qualitative studies on contact with science in everyday life in Switzerland is limited (for an exception see Koch et al., 2019).

Summary of Findings on Switzerland

The Swiss population states that it regularly encounters science in their everyday life. The Science Barometer Switzerland (2019) asks respondents how often they "come into contact with science and research", asking respondents to assess various activities between 1 = "never" to 5 "very often" (FIGURE 4). It shows that the Swiss encounter science most often through conversations with friends and acquaintances (mean frequency of 3.1), films or TV series (2.9), zoos and botanical gardens (2.6), and museums and exhibitions (2.5). It also suggests that everyday conversations are the most common encounter with science for the Swiss on average (more common, as shown later, than news media and online sources) (Science Barometer Switzerland, 2016, 2019).

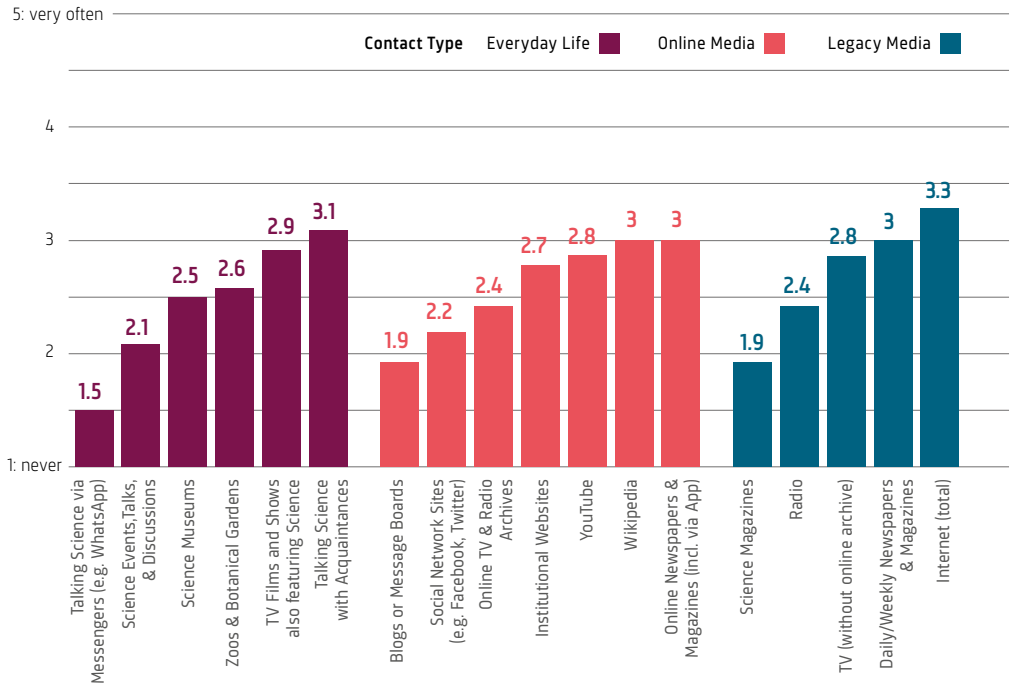

Figure 4: How frequently does the Swiss population encounter science and research across media (legacy and online) and everyday life sources? Results from Science Barometer Switzerland (2019).

Museums and botanical gardens are important for public interactions with science. While encounters with science through conversations, films, and tv series may be more frequent, the importance of museums, zoos and botanical gardens is also well-tracked and established. The Federal Statistical Office (2019c) reports about 3.5 million visits in archaeological, historical and ethnographic museums, 1.9 million in technical museums, and 1.7 million in science museums in 2018 (including foreign visitors).

Engaging with science-related issues in political contexts is more important in Switzerland than in most other countries. About 10% of the European population engage with scientific issues in political context, i.e., by attending public meetings, signing petitions or protesting, by participating in the activities of a non-governmental organization, etc. (Eurobarometer, 2005, 2010b). An analysis of these data across 32 countries shows that Switzerland has the highest proportion of people who engaged at least once in such an activity, likely due to Switzerland's strong direct democracy and high support for democratic control of science (Makarovs & Achterberg, 2018; see also Mejlgaard et al., 2012). This is in line with 73% of the Swiss population "agreeing" or "fully agreeing" that they always participate in public votes that are science related (Science Barometer Switzerland, 2016).

Citizen science seems to have considerable potential in Switzerland. Citizen science, "where people produce scientific knowledge outside of traditional scientific institutions" (Strasser & Haklay, 2018, p. 22), interests more than a third of the Swiss, who indicate they would like to participate in scientific research (Science Barometer Switzerland, 2016, 2019). People with such interest can be divided into five groups: "Free-Timers" (approx. 11% of the population), who are around 55 years old, mostly female, and not employed full-time; "Fully-Employed Parents" (6%), who work full time and often have children at home; "Intrigued Adolescents" (7%), who are 18 years on average and have favorable although not enthusiastic attitudes towards science; "Senior Sciencephiles" (8%), who think very positively about science, are highly educated, mostly male, and around 55 years old; and "Young Sciencephiles" (4%), who are 26 years old on average and have a better gender balance than the "Senior Sciencephiles" (Füchslin, Schäfer & Metag, 2019). Data on how many people are not just interested but are currently active in citizen science projects are not available for Switzerland.

1.3 Contact with Science via News, Online and Social Media

Internationally, analyses of the public's use of news media, online media, and social media with regards to science and science-related issues are well established (Bucchi & Trench, 2021 for an overview). They span news media like newspapers, magazines, radio and television as well as online content on Wikipedia, YouTube, Facebook, Twitter and other social media (Brossard, 2013).

WHAT IS THE EVIDENCE BASE FOR THESE QUESTIONS IN SWITZERLAND?

Amount of data	Quality of data	Published analyses
• solid body of data available • mostly quantitative surveys • focused on contact with "science" in general • channel-based metrics are scarce • little qualitative work	• high quality quantitative survey data (standardized, representative) for information and media sources, but limited to respondents' self-assessment • available metrics capture channel reach only • similar data for specific research fields or science-related issues lacking	• few published analyses available for Switzerland • considerable desiderata

Data on the Swiss population's use of science-related media exist but are limited in quantity and quality. Some published data exist on the audiences of selected publications (e.g., Horizonte, 2019; SRF, 2019), some data are available in (partly unpublished) project reports (e.g., Bonfadelli, 2019), and some data are standard-

ized, representative population surveys (e.g., Eurobarometer, 2005; Science Barometer Switzerland, 2019). Most of these data are limited in scope: Some only report gross numbers such as readership size, while survey data are usually limited to respondents' self-assessments. Data regarding specific issues such as health or environment are largely lacking. These shortcomings contrast the comprehensive data on the Swiss population's media use in general, which is well documented – both through surveys, tracking data and published reports – for print media, television, radio, the Internet and its applications (e.g., European Social Survey, 2018; Federal Statistical Office, 2019a, 2019e, 2019f; Latzer et al., 2019b, 2019a). The amount of qualitative studies on science-related media use in Switzerland is limited with the exception of a study by Koch et al. (2019) that tracked people's science-related media use via smartphone diaries and subsequently discussed their perceptions of science.

Summary of Findings on Switzerland

The Swiss population regularly encounters science through a broad set of media. In 2019, respondents indicated that they encountered science-related content mostly through "the Internet" which, with a mean frequency of 3.3 (REVISIT FIGURE 3 for measurement scale), is the most prominent source of science-related content for the Swiss population, but also via print media (3.0) and television (2.8). For those aged 55 and older, newspapers (3.4) are far more important than the Internet (2.6); while for people aged 15 to 34, the Internet (3.7) is more relevant all other media including newspapers (2.6) and TV (2.3). Men (3.5) encounter science and research on the Internet more frequently than women (3.0) and TV is more important in the French-speaking part (3.2) compared to the Italian- (2.8) or German-speaking (2.7) part (Science Barometer Switzerland, 2019). The general and rising importance of the Internet as the primary source for science-related content is in line with similar surveys in Germany, the USA and the UK (Castell et al., 2014; National Science Board, 2018; Wissenschaft im Dialog, 2019). But it is notable that print media remain one of the most relevant sources for the Swiss population for encountering science-related content (Metag, Maier, Füchslin, Bromme & Schäfer, 2018).

People in Switzerland watch less science-related TV content over time. FIGURE 5 shows how many minutes of TV content categorized as "science & medicine" on Swiss national TV (SRG SSR) people in TV households have watched in total per year between 2013 and 2019. It also shows the number of minutes of such content that were aired in the same year. The data show that people watched less science-related content over time, even though the minutes of such content that were aired remained relatively stable. This likely has several causes: It represents the general decline of TV use in Switzerland. But it is likely also due to changes in TV programming, like moving "Einstein" – arguably the most prominent science-related TV show in Swiss TV – to a less attractive timeslot in 2017 (from 8 pm to around 10.30pm).

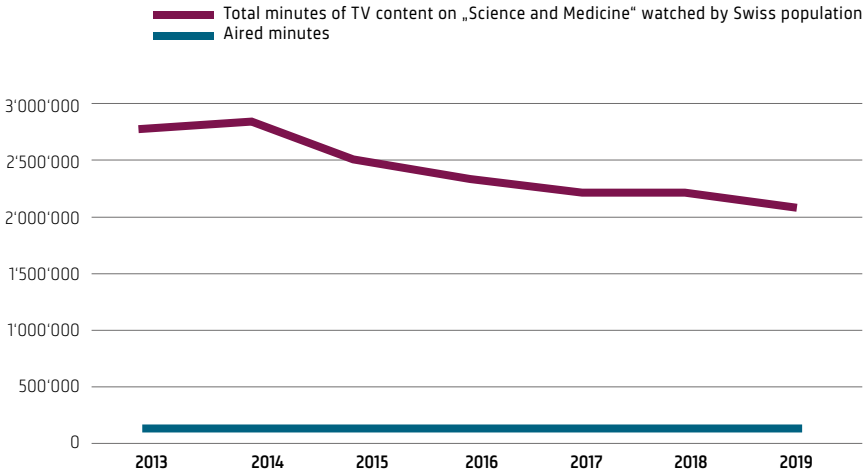

Figure 5: Sum of total minutes watched in the category "science & medicine" by all people in Swiss TV households per year (2013-2019) as well as the total minutes aired by SRG SRR (Mediapulse, 2020).

The Swiss population evaluates science-related news media reporting rather positively, while signaling room for improvement. Overall, science-related topics account for 1 to 3% of news media coverage in Switzerland **(SEE CHAPTER 5)**. The Swiss population sees this coverage as trustworthy, comprehensible and sufficiently extensive (Schäfer et al., 2018). About 70% also agree that it is important to be informed about science and research (Science Barometer Switzerland, 2019). But people's attention to science news, when they encounter it, seems only moderate: Only about 9% pay "a lot" of attention, while 8% "never" pay any attention to it (Science Barometer Switzerland, 2019). This corresponds to 10% of Swiss respondents stating in 2005 that they never "read articles on science in newspapers, magazines, or on the Internet" (Eurobarometer, 2005).

When directly asked whether they are satisfied with science reporting in Switzerland, the Swiss are largely undecided (approx. 44% in the middle of the scale), with only 4% being very satisfied (Science Barometer Switzerland, 2019). This shows potential for improvement in science news reporting, similar to 2010, when 35% of the Swiss population felt "poorly informed" about new scientific discoveries and technological developments (Eurobarometer 2010). During the COVID-19 pandemic, the Swiss population had more pronounced views towards news reporting on the coronavirus: Around 50% of respondents indicated that they felt comprehensively informed by the media, while about a quarter felt that the media were creating panic and exaggerating the pandemic with their continuous coverage (SRG SSR, 2020). It is notable that these percep-

tions got more critical over time (sotomo, 2021). These numbers reflect findings from other countries like Argentina, Germany, South Korea and the U.S. (Kleis Nielsen et al., 2020; Wissenschaft im Dialog, 2020).

The Swiss population regularly encounters science-related content through online and social media. The most relevant online sources for the Swiss are websites and apps of print media (3.0), Wikipedia (3.0) and YouTube (2.8). People aged 55 and older encounter science less frequently through these sources, while people with tertiary education use them more frequently – except for YouTube, which is the most prominent source for younger Swiss aged 15 to 34, and which is used by people with lower education levels more often to encounter science (Science Barometer Switzerland, 2019).

The Swiss population encounters science-related content less often in science magazines, on the radio, in blogs or social networks. The same data show that only few Swiss encounter science and research in special interest science magazines like "P.M." and "Spektrum der Wissenschaft" (1.9) or via radio (2.4). Blogs and message boards (1.9) as well as "Facebook, Twitter, or other social network sites" (2.2) are the least relevant points of contact with science on the Internet. An active use of these platforms regarding science-related issues is even less common: Only about 15% "often" or "very often" "like" science-related posts on social media, and posting or sharing content (6%) and commenting upon it (4%) are even rarer. In comparison to other groups, younger people (2.6), women (2.4), and inhabitants of the French-speaking part of Switzerland (2.5) encounter science and research more often on social media (Science Barometer Switzerland, 2019).

Media contacts with science differ between people with different attitudes towards science. According to Schäfer et al. (2018), the "Sciencephiles" and "Critically Interested" segments of the Swiss population encounter science more often on the Internet, particularly on Wikipedia and YouTube. They also read science magazines more often, which might explain the stable offering of science and education magazines over the last 40 years in Switzerland (Jarren, Oehmer & Dioh, 2020). While the "Passive Supporters" largely mirror the general population in their media use, the "Disengaged" encounter science in the media much less frequently, except when it comes to television, where they are like the rest of the population. A partial explanation of these differences is offered by a qualitative study by Koch et al. (2019) looking at the segments' media use behavior. It found that the "Sciencephiles" and "Critically Interested" recognize science-related content better and based on criteria that largely conform with scientific criteria. The "Disengaged", and partly also the "Passive Supporters", rely more strongly on purely formal criteria (e.g., mentions of the word "study" or "research").

2. From Individual to Organizational Science Communicators: Who Engages with the Swiss Public?

Science communicators are understood here as individuals or organizations who publicly communicate about science or science-related issues. The spectrum of such communicators is broad and includes scientists at institutions of higher education, research institutes and beyond, professional communicators from these organizations as well as from foundations and associations, governmental organizations, political organizations, non-governmental organizations (NGOs) and non-profit-organizations (NPOs) as well as individual influencers, bloggers, YouTubers, etc. (Fähnrich, 2018; Kahan, Scheufele & Jamieson, 2017).

2.1 Communication Activities and Public Engagement by Individual Scientists

Individual scientists are important and highly trusted science communicators. A considerable number of them partake in a wide variety of communication and public engagement activities – from contacts with journalists and media appearances over online activities and social media communication to participatory formats such as science slams, open days, public exhibitions or visits in schools (Niemann, Bittner, Hauser & Schrögel, 2020). They can be encouraged to do so by incentives embedded in the system of science, their organizations or their peers (Rose, Markowitz & Brossard, 2020). Even though the Swiss system of science does not provide very strong formal incentives to encourage public science communication and engagement (in contrast to, for example, the UK "Research Excellence Framework" (REF), that aims to assess societal outreach and impact, among other factors, and ties those with funding decisions, Parker & van Teijlingen, 2012), both stakeholders on the national and cantonal level as well as scientific organizations and scientific peers have encouraged such activities (e.g., Crettaz von Roten, 2011, 58f.; ecoconcept & SAGW, 2015; Swiss Academies Of Arts And Sciences, 2014, 2019).

WHAT IS THE EVIDENCE BASE FOR THESE QUESTIONS IN SWITZERLAND?

Amount of data	Quality of data	Published analyses
• very little data available, limited to a few surveys and qualitative studies	• surveys not always representative, limited to self-assessment of researchers	• very few published analyses available for Switzerland • large desiderata

While many studies have analyzed "the factors and processes that lead scientists to engage in public communication" (Dudo, 2013, p. 476) and the use of social media by scientists (van Noorden, 2014) internationally, few such studies exist for Switzerland. In addition, those that do have notable limitations: Several are rather dated (e.g., Fitzli & Gisler, 2002; Sauter-Sachs, 1992), others are standardized surveys relying on self-reported information from scientists only (e.g., Crettaz von Roten, 2011; Rauchfleisch, Schäfer & Siegen, 2021), and some focus on specific research fields (e.g., Herrmann-Giovanelli, 2013; Stämpfli, 2019), selected universities (Crettaz von Roten, 2011; Sauter-Sachs, 1992) or professors only (Rauchfleisch et al., forthcoming in 2021). Overall, most studies focus on scientists from academic institutions like universities, and not on corporate researchers, scientists at museums, at ministries, in federal agencies, etc. In addition, many of them do not capture a broad spectrum of potential communication and outreach activities, but only assess individual activities like contact to news media and journalists (Rauchfleisch et al., forthcoming in 2021). Notably, studies analyzing Swiss scientists' use of and engagement on social media are missing (Ke, Ahn & Sugimoto, 2017). Comprehensive assessments across disciplines and over time – like those available in the US (Besley, Dudo & Yuan, 2018; Rose et al., 2020) – also do not exist for the Swiss context.

Summary of Findings on Switzerland

There seems to be a considerable openness towards communication and engagement activities among scientists in Switzerland. A 2007 survey of 810 scientists from all faculties of the University of Lausanne showed that 80% agreed that it is "their duty to communicate their research and its social and ethical implications to the non-specialist public", and that 68% think it is possible to "establish a link between their research and the daily concerns of the non-specialist public" (Crettaz von Roten, 2011). Similarly, of the 82 scientists that participated in the Science Barometer Switzerland (2019), 78% agreed that scientists should inform the public about their work. These findings are in line with general diagnoses of an "mediatization" of science, i.e., an increasing orientation of scientists towards media (Schäfer, 2014), with analyses from other countries (Felt, Igelsboeck, Schikowitz & Voelker, 2012; Peters, 2013), and with older studies among professors of the University of Zurich (Sauter-Sachs, 1992, 170f.).

Scientists in Switzerland seem to primarily communicate because they feel a moral obligation to do so, and because they want to correct public misconceptions. Herrmann-Giovanelli (2013) conducted semi-structured interviews with 39 scientists from SNSF-funded national research programs in political science and biotechnology. Results show that researchers think science communication is important, partly because they feel that they have an obligation towards society and want to strengthen the legitimacy of their own research. These motifs are corroborated by Fitzli and Gisler (2002, 130ff.) - who showed many scientists felt a responsibility to communicate because much of their research is

funded by tax money, sometimes saw a need to correct seemingly faulty public views, and got personal satisfaction from public engagement – and by international studies (for an overview Besley, 2013).

Scientists' actual communication and engagement efforts, however, do not seem to match their openness towards them. An output evaluation of more than 6.000 SNSF-funded projects completed between 2012 and 2018 shows that research output of 31% of projects appeared in the media at least once, which equates to 1.2 media appearances per project on average (SNSF, 2020b). Furthermore, scientists from the University of Lausanne – who were surveyed in 2007 – participated in an average of 7.6 outreach activities per year, consisting mostly of public presentations and media articles for lay audiences. This seemingly high average, however, is heavily skewed by the fact that a mere 20% of those scientists accounted to 55% of all activities, with most others engaging very little or not at all (Crettaz von Roten, 2011, p. 65). Similarly, a survey of 1.058 professors representing all disciplines, linguistic regions, and universities of Switzerland showed that respondents reported 5.7 professional contacts to journalists per year. It also showed that while 85% of professors had at least one such contact, only 10% of professors accounted for 50% of all contacts to journalists (Rauchfleisch et al., forthcoming in 2021). At least partly, this is likely due to the media's tendency to approach well-known scholars in the first place, thus making them even more recognizable (Bucchi & Trench, 2020). But in some areas, promising trends are visible. For example, the SNSF's AGORA scheme, which funds science communication projects by individual scholars, has received more applications over the last years (SNSF, 2021), indicating an increase of scientists who engage in science communication. Also, researchers in certain fields such as animal experimentation tend to be more aware of the public relevance of their work and of the need for public communication and engagement (Crettaz von Roten, 2020).

Pronounced differences in the practice of public communication and engagement exist between individual scientists. A survey of professors at Swiss universities in 2016 showed that professors from the social sciences and economics reported most media contacts, with political scientists, economists and sociologists being on top, while professors from the arts and veterinary indicate the fewest media contacts (Rauchfleisch et al., forthcoming in 2021, p. 15). Furthermore, professors with many media contacts are those with more scholarly publications, those who occupy management positions in their organizations, and those who feel confident in their ability to interact with journalists (Rauchfleisch et al., forthcoming in 2021, 16f.). In addition, the aforementioned 2007 survey of 810 scientists at the University of Lausanne showed that men are more likely to publicly engage and communicate than women (Crettaz von Roten, 2011). International studies show similar differences between disciplines (Peters, 2013) scientists' status and leadership positions, and sociodemographic factors (for an overview, see Besley et al., 2018). These differences, however,

may not be driven by the scientists' own preferences or initiative. For example, female scientists at the University of Lausanne did communicate less, but were also contacted less often by the media than men (Crettaz von Roten, 2011).

Social and organizational encouragement influence scientists' public communication and engagement. This has been shown in international scholarship, and quantitative and qualitative studies suggest it holds true in Switzerland as well: Peer feedback and (perceived) social norms within the scientific community have been shown to influence Swiss scientists' openness towards and extent of news media interactions (Herrmann-Giovanelli, 2013, 146ff.; Rauchfleisch et al., forthcoming in 2021). In this light, it is positive that only a minority of 25% of respondents in a 2007 survey agreed that a "scientist who communicates a lot and is often in the public sphere risks being discredited by his colleagues" (Crettaz von Roten, 2011). Organizational factors seem to play a role as well; as professors who can decide themselves how often they want to engage with journalists engage more than those who need organizational approval (Rauchfleisch et al., forthcoming in 2021, 16f.). A majority of scientists in the 2007 survey at the University of Lausanne favored "more active engagement policies" of their organizations (Crettaz von Roten, 2011, p. 66), a finding mirrored in a prior qualitative study (Fitzli & Gisler, 2002, 132f.). Interviewees from biology and political science indicated that time and resources for science communication were often lacking, and expected more organizational support such as media trainings (Herrmann-Giovanelli, 2013, 185ff.).

2.2 Public Communication of Organizations of Science and Higher Education

Organizations of science and higher education – universities, universities of applied sciences and education as well as research institutions, scientific academies, etc. – have become increasingly active communicators in recent years. They engage in various communication and engagement activities around science-related issues (Jarren, 2019), from media releases over participatory formats like open days or children's universities to online and social media activities (for overviews see the contributions in Fähnrich, Metag, Post & Schäfer, 2019). Although scholarship on organizational science communication and engagement with science is growing (Schäfer & Fähnrich, 2020), it is still small (Roten & Entradas, 2020), both internationally and for Switzerland (for an overview see Fähnrich et al., 2019). Notably, almost all Swiss studies focus on universities, while the communication of other institutions of higher education or organizations like museums has not received scholarly attention.

WHAT IS THE EVIDENCE BASE FOR THESE QUESTIONS IN SWITZERLAND?

Amount of data	Quality of data	Published analyses
• very little data available • no comprehensive data sets	• the few existing studies are dated and/or heavily focused on universities	• very few published analyses available for Switzerland • large desiderata

Universities

For Switzerland, analyses of the conditions, resources and strategies of universities' science communication are scarce and have many limitations: Several studies are dated (Anderegg & Kunz, 2003; Sauter-Sachs, 1992; Schanne & Ringger, 1999), others only cover a few universities (Ruß-Mohl, 2017) or are limited to short descriptions of the communication teams' working routines (Ruß-Mohl, 2009, 53ff., 2012, 100ff.). Some data are available on the output of university communication in Switzerland, both on the amount and content of media releases (Ruß-Mohl, 2009, 2012; Vogler & Schäfer, 2020b) and on website and social media activity (Metag & Schäfer, 2017). Overall, however, data are limited, and critical aspects that have been shown for other countries – like the strategic exaggeration of research findings by organizational PR (Bratton et al., 2019; Sumner et al., 2014), the increasing marketing of higher education institutions towards (prospective) students (Röttger & Laukötter, 2019), or the focus on organization reputation and image building instead of scientific results (Marcinkowski, Kohring, Fürst & Friedrichsmeier, 2014, p. 122) – are difficult to assess for Switzerland. But with these caveats, some results can be extracted from the available scholarship:

There is a growing emphasis on public communication and engagement within universities, accompanied by an increasing allocation of resources to these activities. For the 1990s, Schanne & Ringger report that public information and communication were seen as obligations Swiss universities had to fulfill, but that little resources were devoted to it (Schanne & Ringger, 1999, p. 7). In addition, Swiss universities often had no clearly defined communication strategies, and their communication teams were not heavily involved in strategic processes of the entire organizations (Anderegg & Kunz, 2003, 144ff.; Schanne & Ringger, 1999). Nowadays, Swiss universities have professionalized their communications teams (Hafner, 2020; Ruß-Mohl, 2009, 53ff., 2012, 101ff.), and the personnel and financial resources available to those teams have grown considerably (Hedder, 2019; Ruß-Mohl, 2017), particularly in the large universities, the Federal Institutes of Technology, and in organizations in the French-speaking part (Hafner, 2020, 64ff.). In 2018, the University of Lucerne had 5 full-time equivalent positions for public communication, the University of Zurich had 18, and EPFL 23 (Hafner, 2020, p. 70). This mirrors studies from other countries showing that communications teams in scientific institutions have grown,

professionalized and become a central and strategic component of higher education governance (Barathon, 2017; Lessmöllmann, Hauser & Schwetje, 2016; Marcinkowski et al., 2014).

The output of university's communication teams has grown and strongly focuses on organizational matters. Universities in Switzerland publish a significant amount of news and media releases per year. For example, ETH Zurich and the University of Zurich – two of the country's most active communicators – each published over 300 press releases in 2018. A study of the University of Zurich demonstrates that the number of those media releases also rose over time, at least since the mid-2000s (Vogler & Schäfer, 2020b). In addition, in 2012, a content analysis of 671 university media releases demonstrated that only 34% of them focused on research, while 66% dealt with "institutional" issues, showcasing a stronger focus on strategic issues and potentially making them "mouthpieces of the presidents or rectors" (Ruß-Mohl, 2012, p. 102). Generally, a stronger professionalization and more strategic orientation of organizational communication around science has been diagnosed by scholars (Hafner, 2020; Ruß-Mohl, 2012), even though robust evidence backing this up on the level of organizational routines and structures is still lacking. This is in line with findings from other countries demonstrating that the communicative output of scientific organizations has increased strongly (Serong et al., 2017).

Public communication of Swiss universities addresses diverse target groups, using a broad range of channels. The communication teams of Swiss universities often grew out of teams responsible for media relations, and the work towards the news media as well as the production of "remarkable print publications" (Ruß-Mohl, 2009, p. 53) are still important parts of their portfolio. For example, magazines like "Allez savoir!" of the University of Lausanne or "UZH Magazin" of the University of Zurich are freely available and high-quality print products that focus on presenting the universities' research(ers) to the public. But their communicative work has diversified. Beginning in the 2000s, the production of media releases and organizational print publications was flanked by webpages, brochures and the organization of events, networking and broader stakeholder relations as well as an increasing focus on internal communication (Anderegg & Kunz, 2003, 83ff.; 115ff.). Communicators at that time already felt they had to address numerous internal (students, staff, alumni) and external (general public, scientific community, other Higher Education Institutions, politics, the economy, etc.) stakeholders (Anderegg & Kunz, 2003, 90ff.). This has increased further with the emergence of social media: All universities use channels like Facebook and Twitter by now, and Swiss universities do so more intensively than universities in Germany or Austria, even though they often under-utilize the interactive and multimodal potential of platforms and do not clearly differentiate between target groups in their social media communication (Metag & Schäfer, 2017, p. 193). It seems that particularly large and resourceful universities use the options provided by online and social media most proficiently,

translating their pre-existing communicative advantage into the online and social media environment as well (Hafner, 2020, 64ff.; Metag & Schäfer, 2017, 182f.). International studies show a similar diversification of organizational communication around science, which addresses more stakeholders and target groups (Röttger & Laukötter, 2019), and uses more and more communicative formats and channels (Barathon, 2017), while the most resourceful organizations are most likely to include a variety of online channels (Entradas et al., 2020).
Higher education institutions are important providers of engagement formats. Most universities offer events such as open days and public lectures to invite a broader public to learn and reflect about scientific issues and methods (Fähnrich et al., 2019). Examples are the Scientifica by the University of Zurich and ETH Zurich, the Open House by EPFL and the Explora at the University of Fribourg. While these and other, similar events are well known, there are no overviews about these and other engagement initiatives offered by Swiss universities. The data would be readily available, as most institutions document their own activities on their websites and in annual reports. A continuous case by case data collection over a longer period would complete the picture on higher education institutions as science communicators.

Universities of Applied Sciences

Switzerland has eight public universities of applied sciences, which were founded since the 1990s. They differ from universities, first, because their teaching and research is more focused on applied topics and more focused on collaborations with the private and corporate sector. Second, their formal structures are often more hierarchical and geographically disparate. For example, HES-SO – the Haute école spécialisée de Suisse occidentale with their main offices in Delémont – has about 21.000 students, making it one of the biggest Swiss institutions of higher education, but is divided into 28 schools across seven cantons. Each school can engage in science communication and public engagement relatively independently, while the administrative center of HES-SO focuses on communication towards politics as well as organizational marketing. Swiss universities of applied sciences often have such decentralized structures, even though their characteristics may differ from one university of applied sciences to another. Zurich-based ZHAW, for example, also spans multiple locations, but all within the canton of Zurich. Its administrative center, however, is itself part of another umbrella organization, the Zürcher Fachhochschule (ZFH), which includes other universities of applied sciences and education.

As a result of these structural characteristics, universities of applied sciences have smaller communication teams, which are more focused on communicating to attract students than to publicly communicate about their research. Many universities of applied sciences are, however, interested in increasing their science communication efforts (Hafner, 2020), and are, in that regard, sim-

ilar to universities. Therefore, more research on these science communication and public engagement efforts is needed; as of right now, such scholarship is lacking.

Universities of Education and other Universities

Switzerland is home to almost 20 universities of education, like the "Haute Ecole pédagogique du Valais" (HEP-Valais) or the "Pädagogische Hochschule Graubünden" (PH Graubünden), as well as other federally accredited universities such as the private organizations "Kalaidos Fachhochschule". Universities of education are similar to universities of applied sciences in their more practical, applied orientation. The focus of their application, however, is even more defined, as universities of education are educating teachers for Switzerland. Research activities play a secondary role in universities of education, and their public communication activities seem to be less pronounced – but data and research on these questions are lacking.

Research Institutions

Apart from federally accredited universities, there are numerous research institutions in Switzerland. Some of them are federal organizations like the "Swiss Federal Laboratories for Materials Science and Technology" (EMPA) and the "Institut für Schnee- und Lawinenforschung" (WSL), others like "The European Organization for Nuclear Research" (CERN) are international organizations. These research institutions communicate their research to the public, and many are active in engagement activities. They not only produce annual reports but also publish reports on specific research topics and, in the case of CERN, provide numerous engagement activities for schools as well as the general public, like exhibitions, guided tours and special events and presentations. Again, there are no studies looking at the science communication activities of such research institutions in Switzerland.

Funding Institutions

Switzerland offers a favorable funding landscape for scientific research, and also for funding science communication. On the one hand, public funding institutions invest in science communication and public engagement with science. The most prominent such institution is the Swiss National Science Foundation (SNSF), which granted over one billion Swiss francs to over 6.000 research projects in 2019 (SNSF, 2020a). It also funded science communication with more than 9 million Swiss Francs in 2019, e.g., through the AGORA funding scheme which sponsors scientists' efforts to communicate their research in dialogical formats, and supported almost 7.000 events that aimed at knowledge transfer through presentations, workshops and exhibitions between 2015 and 2019 (SNSF, 2020a). The SNSF also established structures that encourage or

even demand science communication from grant recipients: All research projects must provide a lay summary that is available online in various languages. Large projects like National Centers of Competence in Research (NCCR) are asked for more comprehensive science communication planning and activities. National Research Programmes (NPR) that include public engagement with science efforts are encouraged. Additionally, SNSF publishes the free magazine "Horizons - The Swiss Research Magazine", supports media trainings for researchers and has regulations that stipulate that apart from the quantity and quality of publications, scholars' engagement in teaching, in administration and in outreach towards the society in general should be taken into account when possible.

Other key institutions are Switzerland's scientific academies. They include the Swiss Academy of Humanities and Social Sciences (SAHS), the Swiss Academy of Medical Sciences (SAMS), the Swiss Academy of Sciences (SCNAT), and the Swiss Academy of Engineering Sciences (SATW), all united under the umbrella of the Swiss Academies of Arts and Sciences. The academies focus specifically on being a mediator between science and the public. They engage in various communication activities, from providing fact sheets on topics such as open science and climate change, to organizing public talks and events (Swiss Academies Of Arts And Sciences, 2020a). Moreover, the Swiss Academies of Arts and Sciences host "Science et Cite", their competence center for science-society dialogue, and the expert group that authored this report.

On the other hand, private foundations fund science communication projects in Switzerland as well. The Gebert Rüf and Mercator Schweiz foundations, for example, have funded projects ranging from interactive exhibitions about science-related issues over computer games to novel formats of science journalism (e.g., Gebert Rüf Stiftung, 2020).

2.3 Science Communicators beyond Institutionalized Science

Science is not only communicated by scientists and scientific organizations. Although they differ in their relation and proximity to the scientific system, museums, associations and foundations, governmental organizations, political actors or other non-governmental/profit organizations regularly communicate about science with the public. Additionally, individual science communicators also play a role in Switzerland, both in news media and on social media. Social media in particular allow more, and more diverse, actors to engage in communication about science-related issues (Brossard, 2013; Brossard & Scheufele, 2013), leading to a larger diversity of content and opinions (Fahy & Nisbet, 2011). In the case of Switzerland, however, this diversity has not been addressed yet with a large amount of scholarship analyzing it.

WHAT IS THE EVIDENCE BASE FOR THESE QUESTIONS IN SWITZERLAND?

Amount of data	Quality of data	Published analyses
• very little data available • no comprehensive datasets beyond museum statistics	• the few existing datasets on museums are comprehensive and of high quality	• almost no scholarly analyses for Switzerland • large desiderata

Individual Communicators

Individuals from within and outside organized science have always played a role in public science communication, and the rise of online, social and mobile media has provided them with new communicative tools. These individual communicators include citizen journalists (Allan & Ewart, 2015), bloggers (Joosse & Brydges, 2018), YouTubers (Allgaier, 2020) and influencers (González Romo, Iriarte Aguirre & Garcia Medina, 2020), and they have been shown to engage in content-production, factchecking and content evaluation (Graves, 2013; Schäfer & Painter, 2020). Some of them have multiple roles, e.g., being employed in scientific organizations as well as communicating science on social media. The COVID-19 pandemic provided examples of these dynamics: Communication by governmental institutions (e.g., Federal Office of Public Health), federal expert groups (e.g., Swiss National COVID-19 Science Task Force, 2020) and science journalists (e.g., Heidi.news; Higgs.ch) was flanked by individual communicators such as computer scientist Daniel Probst, whose website "corona-data.ch" became an important source for the public for information about infection numbers.

Data on the number, characteristics, or diversity of individual science communicators in Switzerland are almost non-existent, with the notable exception of Hafner (2020). This is not surprising, as international research on the role of these intermediaries is scarce in general, with some exceptions for fact-checkers (Graves, 2016; Lim, 2018), Bloggers (Schäfer, 2012) and case studies on citizen journalists (Allan & Ewart, 2015). The very little scholarship available for Switzerland suggests that the country has a very small, albeit somewhat diverse, landscape of individual science communicators. On the one hand, it seems that a small number of blogs – such as "Geschichte der Gegenwart" or the "ETH Zukunftsblog" – host a large portion of the science-related posts by individual communicators, similar to the academic blogosphere in Germany (Fecher & Kaiser, 2015). On the other hand, selected scientists from Swiss institutions have a large followership and reach considerable audiences on social media like YouTube and Twitter. Lausanne-based scientist Lê Nguyên Hoang (also known as "Science4All"), for example, has almost 200.000 subscribers on YouTube (with a majority following from France), while communications scholar Miriam Meckel of the University of St. Gallen has more than 50.000 followers on Twitter. Generally, it seems that a small selection of scientists were able to match the level of followers and subscribers of scientific institutions such as ETH Zurich and EPFL who indicated

that they had between 50.000 to 70.000 on Facebook and Twitter in 2019 (Hafner, 2020). While those subscriber numbers indicate a certain hierarchy, it remains unclear how much audience engagement they actually entail.

Museums

Museums[3] such as science centres "constitute major settings of science learning with unique characteristics of informal science education" (Schwan, Grajal & Lewalter, 2014, p. 70). They can be understood as institutions that primarily engage in science communication and engagement, and sometimes even conduct their own research. Their presence is well-documented in Switzerland through a regular census by the Federal Statistical Office (2019c). According to the latest numbers from 2018, there are about 1.120 museums in Switzerland. The most common museum types are local and regional (33%), art (15%), technology (14%), and history (11%) museums. Survey data show that these museums rank among the public's most important points of contact with science and research (Science Barometer Switzerland, 2019).

Museums are set in a highly diverse communication environment: Their target groups are heterogenous, spanning a wide range of sociodemographic groups with different motives, and they have wide set of communication tools available to them, including real and authentic objects for display, visual elements, story-telling and hands-on activities, all situated in a physical setting that allows museums to present information across space (Kim & Dopico, 2016; Schwan et al., 2014; Tran, 2007). These in situ modes of communication can be flanked by public communication through websites and social media channels (Baker, 2017).
Unfortunately, no data exist on Swiss science museums' communication and engagement activities. Summaries on the numbers and communication formats of exhibitions and other activities are missing, as are systematic insights on the use of digital tools such as websites and social media channels. Like engagement activities of higher education institutions, such information may be available for individual museums in their annual reports. For example, the Museum of Transport in Lucerne uses its annual report to describe its main communication activities, events and special exhibitions, as well as the number of total visitors per exhibition and attendance of school classes and pupils (Museum of Transport, 2019). Similarly, information and evaluations of individual exhibitions that were funded by the Swiss National Science Foundation can be accessed through the SNSF's P3 database (SNSF, 2021), and could be gathered and analyzed systematically in the future.

[3] "A museum is a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment." (ICOM, 2007)

Governmental Organizations

Many Swiss governmental organizations and agencies publicly communicate on science-related issues, including communication about the scientific system and its governance. Probably the most visible examples are the Swiss Federal Office of Public Health (FOPH) which was particularly active during the COVID-19 pandemic, the State Secretariat for Education, Research and Innovation (SERI), or the Federal Office for the Environment (FOEN). Relevant governmental organizations also include, however, other federal as well as cantonal bodies which communicate about science-related issues, particularly in the context of new legislation. In line with legislation such as the Aarhus convention and the Environmental Protection Act, for example, governmental organizations like the FOEN provide information transparency and aim to "inform the public" (Swiss Federal Chancellery, 1983, 2014). As a result, their public communication efforts often come in the form of media briefings, statements and reports as well as large-scale communication campaigns (Bonfadelli & Friemel, 2010). Overall, they seem to engage mostly in one way communication, similar to other countries (Bielaka, Campbell, Shealagh, Schäfer & Shaxon, 2008). Many of these organizations are often also present on social media, where studies from the US observed mostly unidirectional communication as well (DePaula, Dincelli & Harrison, 2018; Lee & VanDyke, 2015; Thackeray, Neiger, Smith & van Wagenen, 2012).

While systematic analyses of governmental science communication are missing in Switzerland, it has to be considered that the Swiss government often funds independent foundations and associations like the Swiss Council for Accident Prevention (BFU), Sucht Schweiz, TA-SWISS or Science et Cité that engage in various forms of science communication.

Publicly Funded Foundations & Associations

Several publicly funded foundations and associations are dedicated to communicating and engaging with the public around science-related issues. Examples are the foundations Science et Cité and the Centre for Technology Assessment (TA-SWISS). Both are part of the Swiss Academies of Arts and Sciences and receive public funding but are independent in their communication activities and messages. As an independent foundation, TA-SWISS produces information and interdisciplinary assessments on (potentially) controversial technologies for the Swiss parliament, the Federal Council and the electorate (e.g., TA-SWISS, 2020). Science et Cité encourages science-society dialogue as well as public feedback to the scientific community, and specializes in low-threshold communication that often contains direct contact between scientists and citizens (e.g., Science et Cité, 2016). It also organizes the annual "ScienceComm" conference that fosters dialogue and new initiatives between science communicators in Switzerland. In specific fields, many other organizations engage in science communication and public engagement – especially in the health domain (Schneider Stingelin,

2014), where the Federal Health Insurance Act makes funds available to Health Promotion Switzerland for communication campaigns and evaluations (Spencer et al., 2008).

NGOs and NPOs

Switzerland has a large number and broad range of non-governmental and non-profit organizations, and many of them communicate publicly on science-related issues (e.g., Seibt & Alexandra, 2014), even though they differ in how much they focus on these issues and in the type of communication they produce. Some focus on participatory formats and public engagement like "Hackuarium", a not-for-profit association aiming to democratize science by inviting everyone interested to do their own research in open laboratories – following ethical guidelines and principles of open science. In contrast, associations like Interpharma communicate science from a corporate perspective and mainly by compiling scientific reports for the public. Organizations like Greenpeace, Doctors Without Borders and Avenir Suisse have all been known to communicate about science-related issues such as gene technology (Bonfadelli & Dahinden, 2002) antibiotics resistance and 5G cellular technology, respectively. Many of these organizations have clear political goals but lack direct access to decision makers. Consequently, communication via press releases, demonstrations and other public events is key for them to generate public attention, ideally magnified by media reporting (Hansen & Cox, 2015). As a result NGOs are known to engage in various forms of communication activities, from interpersonal communication to news and digital media (Cox & Schwarze, 2015). Particularly the online environment facilitates these organizations linking up with like-minded organizations and strategically occupying and framing certain science-related issues (Häussler, Adam, Schmid-Petri & Reber, 2017; Schmid-Petri et al., 2018).

Furthermore, a number of communicators have emerged in the context of social mobilization, most visibly around the "March for Science" and the climate change-related "Fridays For Future" (FFF) movement. Both the movements themselves as well as scientists have communicated about these issues, with arguably the most notable example being the "Scientists For Future" campaign supporting FFF.

Furthermore, several large NPOs and associations in Switzerland produce their own (trade) magazines. For example, the Touring Club Switzerland (TCS) publishes its Touring-Magazin in German, French and Italian, with a circulation of 1.4 million copies, ten times per year. Similar to many magazines in Switzerland (Jarren, Oehmer & Dioh, forthcoming), the Touring-Magazin often incorporates science-related facts and figures (for an example see **FIGURE 6**). Given the, sometimes considerable, circulation of their magazines, some NGO and NPO publishers are among the most relevant science communicators in Switzerland. Yet, there are no studies available for Switzerland on the quantity and quality of the science communicated in these publications.

Figure 6: Infographic in the "Touring-Magazin" (TCS, 2020, pp. 12–13)

Political Organizations and Politicians

Political organizations and politicians are often target groups for science communicators trying to inform or influence political discourse (Messerli, Pohl & Neu, 2015). But they also appear as science communicators themselves. A look into the five biggest Swiss parties shows that they not only rely on scientific insights to make arguments about topics such as climate change, the energy sector, or genetically modified organisms. Most parties also directly address the relevance of research and higher education for Switzerland programmatically. It is, therefore, not surprising that politicians rely on scientific consultancy and incorporate talking about scientific findings in their public communication (Schütz-Ierace, 2010). Similar to the highly strategic communication of activists (Offit, 2018), politicians are often accused and sometimes shown to misrepresent and "mangle" scientific evidence to fit their argumentative goals (Levitan, 2017; Willis, 2017). How much politicians talk about scientific evidence directly and how adequately they incorporate it into their arguments has not been investigated for Switzerland yet.

3. Science Journalism in Switzerland

Science journalism selects, aggregates, and presents science-related content to the general public according to professional criteria and routines (Blöbaum, 2017). Understood broadly, this includes both specialized science journalists who work in dedicated science beats as well as journalists working on science-related issues in other beats, e.g., in the politics, culture or sports beats (Summ & Volpers, 2016). Science journalism is an important mediator between science and society. Historically, news media have played a crucial role in science communication, and they are still one of the most important channels through which people encounter science-related content (Dunwoody, 2014). Recent Science Barometer Switzerland (2016, 2019) surveys show that this is also true for Switzerland (SEE ALSO CHAPTER 1). Therefore, it is important to know who Swiss science journalists are, how they are embedded organizationally, and under what conditions, with which role-perceptions and working routines they work.

WHAT IS THE EVIDENCE BASE FOR THESE QUESTIONS IN SWITZERLAND?

Amount of data	Quality of data	Published analyses
• comprehensive data available on Swiss journalism in general • considerably less data on science journalism in particular	• data on science journalism is either dated, not representative or incomplete • compared to comprehensive survey data on Swiss journalism in general	• very few scholarly analyses available for Switzerland • insights often remain essayistic and anecdotal • considerable desiderata

Few studies have analyzed science journalism in Switzerland. As a result, little and often dated evidence exists about basic questions like the number of science journalists in the country, their embedding in different media organizations, their working conditions, or the development of those over time. Even though several large-scale surveys were conducted among journalists in Switzerland (for overviews Hanitzsch, Seethaler & Wyss, 2019; Keel, 2011, 102ff.), they do not focus on the science beat (e.g., Bonfadelli, Keel, Marr & Wyss, 2012, p. 20; Dingerkus, Dubied, Keel, Sacco & Wyss, 2018, p. 124). Those of the studies that mention science journalism at all do so in passing (Hanitzsch et al., 2019; Keel, 2011; Puppis, Schönhagen, Fürst, Hofstetter & Meissner, 2014), and only a 2015 survey (Kristiansen, Schäfer & Lorencez, 2016) and a survey among members of the Swiss Association of Science Journalists (SASJ) done by the association itself (Füchslin, 2020) focused on science journalists specifically. Beyond that, essayistic and dated accounts provide fragmented and sometimes anecdotal evidence about the situation of Swiss science journalism (Breu, 2004; Hafner, 2020; Heuss, 2004; Ruß-Mohl, 2009, 2012). Many aspects of science journalism that have been analyzed in international studies – such as the broader changes in organizational embedding and working conditions (cf. Dunwoody, 2014) or

the challenges and chances connected to the emergence of online, social and mobile media (Fahy & Nisbet, 2011, p. 785) – have not been analyzed for Switzerland.

Summary of Findings on Switzerland

Switzerland offers different educational opportunities for (further) education of science journalists. Switzerland hosts renowned journalism schools, such as the privately funded MAZ, which provides larger Certificate of Advanced Studies (CAS) programs on both science and data journalism, as well as smaller courses on topics like data visualization available for all interested journalists. In addition, MAZ's main 3-year journalism program includes two mandatory days of training in science-related reporting.

Journalists from various beats and backgrounds produce science journalism in Switzerland. General surveys among Swiss journalists show that many journalists who are not working at specialized science desks indicate that they work on science-related topics: In 2009, 32,9% of all Swiss journalists across beats said they also covered science, with a particularly high percentage at SRG (46,1%) (Keel, 2011, p. 147). This is even more pronounced in the US, where the "vast majority of articles on emerging technologies are written by reporters whose primary responsibilities do not involve scientific topics", which may cause problems for issues "such as nanotechnology, that combine complex basic research, high levels of scientific uncertainty, and multifaceted policy dilemmas" (Scheufele, 2013, p. 14042).

There seem to be about 100 specialized science journalists in Switzerland, i.e., journalists that work on the science beat at least part-time. A 2009 study reported that about 60 science journalists worked in the media houses of the German-speaking part of Switzerland, sharing 40 full-time position equivalents (Ruß-Mohl, 2012). A 2020 survey among members of the Swiss Association for Science Journalism (SASJ) showed that of the 73 "regular" members[4] responding to a survey, 37% were permanently employed science journalists and 30% were working as freelancers. If these numbers are extrapolated to all 151 "regular" members of the SASJ, this would translate to about 60 permanently employed science journalists and 40 freelancers in Switzerland, i.e., to 100 specialized science journalists in total (Füchslin, 2020). This is in line with earlier studies showing that specialized science journalists are a small group, representing 2 to 6% of journalists in Switzerland (Bernet & Keel, 2002, 2005, 2009; Enquete 2008

[4] According to the SASJ, "regular" members are active in journalism, i.e. permanent employees and freelancers who earn a substantial part of their livelihood from journalism. "Extraordinary" members work in the broader field of science communication, e.g. in communication departments for universities and research institutes, are retired, work as journalists in other beats and/or pursue the career goal of science journalism.

cit. in Keel, 2011, p. 145; Puppis et al., 2014; Saxer & Schanne, 1981), and with a more recent study reporting a proportion of about 4% (Lauerer, Dingerkus & Steindl, 2019, p. 81). These numbers are on par with, and even slightly higher than in, countries like the US, Germany and Norway, where studies have estimated the proportion of specialized science journalists to be around 1 to 3% (Schäfer, 2011, 403f.).

Specialized science journalists aim to provide information and orientation, and less commonly to function as watchdogs of science. Surveys indicate that a large majority of specialized science journalists in Switzerland considers themselves to be neutral mediators of science. On a scale of one ("not at all important") to five ("very important"), "depicting reality as it is" (4.85) and "providing the audience with necessary orientation" (4.58) are among their most important self-conceptions. Considerably fewer journalists see themselves as watchdogs aiming to identify and publicize erroneous developments and problems within science (3.73) (Kristiansen, Schäfer & Lorencez, 2016, 134f.).

Specialized science journalists in Switzerland have a higher formal education than other journalists and resemble science journalists in other countries. Kristiansen et al. (2016) surveyed 78 specialized science journalists in Switzerland in 2015. They showed that Swiss science journalists resemble those in other countries socio-demographically, but differ from Swiss journalists in general: They were more likely to have a university degree, but less likely to be permanently employed and working full-time – also due to media houses laying off science journalists or closing science desks altogether (Dunwoody, 2020; Hafner, 2020).

The number of Swiss media houses still featuring science desks or specialized science journalists is small, and declining. Historically, and in other countries as well, science desks were always less common in media houses than other desks like politics, economics, culture or sport, and mainly existed in larger quality media (Dunwoody, 2020). Anecdotal evidence suggests that these trends are also true for Switzerland (e.g., Ruß-Mohl, 2012). Legacy media in the country seem to allocate fewer resources to science journalism, closing down specialized science beats and relying more on freelancers (Demuth, 2013; Heuss, 2004). In recent years, the already small number of Swiss media houses featuring specialized science journalism has declined further. According to the Swiss Association of Science Journalists[5], specialized science journalists with permanent employment only still exist at the public service broadcaster SRG, at "CH Media", at "Le Temps", at "Neue Zürcher Zeitung" and "NZZ am Sonntag", at "Republik" and at "TX Group".

[5] This information was presented in an internal workshop on science journalism in Switzerland, jointly organized by the Expert Group and the SASJ.

Science journalism is facing significant challenges in the changing media ecosystem. Media houses are under economic pressure in Switzerland in general (e.g., Künzler, 2013; Puppis et al., 2014; Widmer, 2020), and accordingly, journalists' working conditions have been worsening, with increasing workloads, decreasing personal and professional freedom and less time to research stories. As a result, more journalists often work temporarily and part-time (Dingerkus et al., 2018, p. 122). Working conditions for science journalists are also getting worse. For example, they have less time for on-site research, clear deadlines give way to a "24/7 rhythm of the internet" (Ruß-Mohl, 2012, p. 99), and they re-print agency copy or press releases more often (Heuss, 2004; Vogler & Schäfer, 2020b). This is paired with the observation that science beats are perceived as of minor relevance in media houses in Switzerland (Dietrich-Gsenger, Marlene & Seethaler, 2019, p. 69) – like they are in other countries (e.g. Nelkin, 1995).

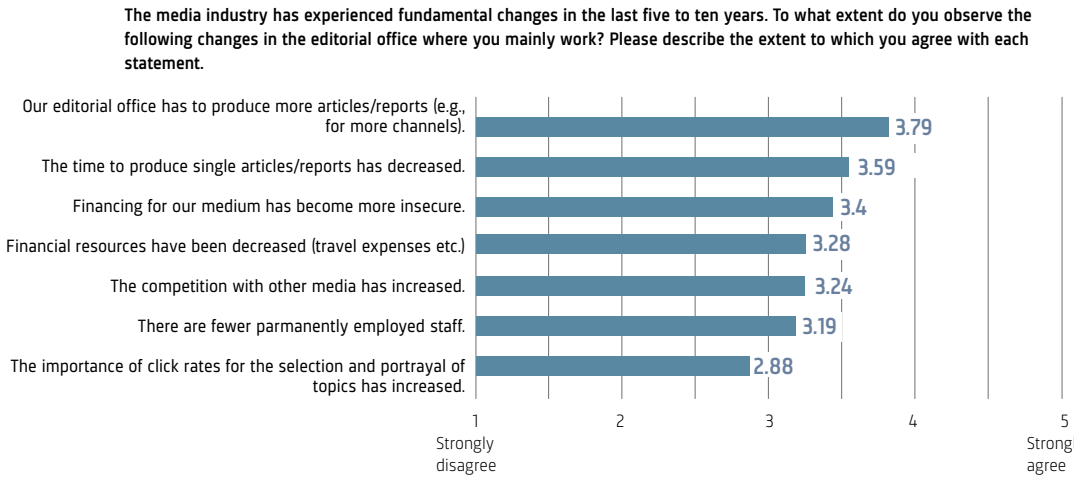

Figure 7: Responses of 78 science journalists in Switzerland in a 2015 survey (Kristiansen, Schäfer & Lorencez, 2016, p. 138)

Kristiansen et al.'s survey of specialized science journalists shows that journalists perceive this change as well (FIGURE 7). While most specialized science journalists are content with their job, with their profession at large and with the quality of their work, they report that working conditions have worsened in the five years prior to the 2015 survey: They state that they are expected to produce more output, that their media houses' financial stability has decreased, that competition is intensifying and that more and more professional media releases have to be dealt with in less time. First studies indicate that the amount of PR content that is found in journalists' reporting has increased over time, also in Switzerland (Sumner et al., 2014; Sumner et al., 2016; Vogler & Schäfer, 2020b). But Swiss science journalists do not think that science journalism in the country will default to 'cut, paste, and translate' journalism – so-called "churnalism" (Bauer & Gregory, 2007). These views are held by most respondents except SRG

journalists (specifically from the German-speaking branch of SRG), who perceive fewer changes in their working environment than colleagues from other media, even though they do perceive that "working conditions in journalism are changing in general," and "permanently employed journalists perceive more significant changes in their personal work than freelancers do, which could be a sign of the media crisis hitting publishing houses and/or science desks" (Kristiansen, Schäfer & Lorencez, 2016, 135f.). In addition, the situation of freelancing science journalists in Switzerland is problematic as well: With declining resources in media houses, many of them seem to find it increasingly difficult to be hired, and to make a living with the fees they receive[6].

Models of science journalism in Switzerland

Philanthropic science journalism for legacy media

"20 Minutes" – the free daily newspaper with the largest circulation in Switzerland, published by the TX Group (formerly Tamedia) – was an example for philanthropic science journalism: As "20 Minutes" did not feature a science section or desk, the Gebert Rüf and Mercator foundations funded a communications agency to produce two weekly "Knowledge" pages for the newspaper (Schanne, Koch, & Wyss, 2013). The content was researched, written, typeset and layouted entirely by the agency, and printed by the newspaper free of charge (Ruß-Mohl, 2012, p. 96).

Institutionally funded science journalism at the national news agency

Swiss news agency **"Keystone-SDA"** (formerly SDA) is an example for institutionally funded science journalism: Its two science journalists were initially paid by CRUS - the Association of Swiss University Rectors (Demuth, 2013), and are now funded by swissuniversities, the Swiss National Science Foundation (SNSF), the Swiss Academies of Arts and Sciences and the ETH Council. Journalistic independence is contractually ensured. The amount of science news produced by "Keystone-SDA" rose by 38% within one year after the establishment of the "SDA Wissenschaftsdienst" in 2008 (Schanne, 2010) and amounts to some 400 news self-produced news pieces a year. The service is available to approx. 150 media outlets that have subscriptions to the SDA "Basisdienst".

[6] This information was presented in an internal workshop on science journalism in Switzerland, jointly organized by the Expert Group and the SASJ.

New models of science journalism are tried in Switzerland, aiming to balance editorial independence and quality with economic success and sustainability. Similar to other countries, where new models of science journalists are being tried out (for overviews Dunwoody, 2014; Fahy & Nisbet, 2011), new organizational models of science journalists are tried in Switzerland (see below). So far, none of these (partly ongoing) models have alleviated the increasing worries of science journalism in Switzerland (Amrein & SKWJ, 2020).

Online-born science journalism with diversified funding

In French-speaking Switzerland, **"Heidi.news"** has founded an ad-free and primarily subscription-based model for science journalism, publishing a mixture of topical feeds, "explorations" and multimedia articles (Hirschi, 2019). Established in 2019, it initially drew on reader donations and philanthropic funding and is switching to a subscription model. It cooperates with higgs.

"Higgs", working from and in German-speaking Switzerland, has set up an online-platform focusing on self-produced science journalism, it incorporates content from other providers (like the "Horizons" magazine from SNSF and the Swiss Academies of the Arts and Sciences). "higgs" distributes its content via its website, but also via local and regional newspapers, social media and video screens in public transport (Weißschädel, 2018). "higgs" is ad-free; its funding model combines sponsored content with funding from individual readers and crowdfunding, philanthropic organizations, private and public institutions. The platform announced to switch to a subscription-based model as well.

International models of (support for) science journalism

Swiss journalists reporting on science-related topics can also use infrastructures providing support to (science) journalists from other countries. One example are the **"Science Media Centers"**, one of which exists in Germany, which deliver raw material for journalistic reporting such as quotes and factsheets free of charge. Another example are web portals aggregating media releases from research and higher education institutions such as **"EurekAlert"** or the "Informationsdienst Wissenschaft" (idw). A third example is **"The Conversation"** (which is available in French and several other languages) which provides free articles on contemporary issues written by academics but supported by a newsroom. In Switzerland, universities like the ETH Zurich or the University of Lausanne (through the "Avis D'Experts" platform) provide data bases of (their) experts by topics, allowing journalists to find and contact them more easily.institutions. The platform announced to switch to a subscription-based model as well.

4. Digital Platforms: The Role of Google, Facebook and Co

Digital platforms – programmable infrastructures with a focus of collecting, curating and disseminating content – have become some of the most important intermediaries of public communication (Helmond, 2015, p. 5; Napoli, 2015). Such platforms exist in different shapes and with different primary functions: as search engines such as Google, as news aggregators like Google News, as social networks such as Facebook or Twitter, or as content sharing platforms such as YouTube or TikTok (Neuberger, 2014). They can steer communication towards or away from certain topics, voices or positions, and do so by following rationales that differ from traditional intermediaries like journalists, largely using algorithmic curation and aiming to maximize user engagement for commercial purposes (Gillespie, 2010; Helmond, 2015, p. 5).

The rise of digital platforms has strongly affected science communication (Brossard, 2013; Leßmöllmann, 2020): Scientists use both scholarly and general-interest social media, scientific organizations use different online media for communication and public engagement, novel forms or citizen participation in science such as citizen science efforts or platform-based crowdfunding, etc. (Franzen, 2020; Mirowski, 2018). Social media are already home to some of the most popular sources for science-related content globally (like the Facebook page "I Fucking Love (IFL) Science" with 24 million subscribers, see Hitlin & Olmstead, 2018).

WHAT IS THE EVIDENCE BASE FOR THESE QUESTIONS IN SWITZERLAND?

Amount of data	Quality of data	Published analyses
• almost no data available specifically for CH, limited to anecdotal observations	• anecdotal insights on individual new intermediaries, neither systematic nor representative	• almost no published scholarly analyses available for Switzerland • large desiderata

A considerable number of studies is available on the role of digital platforms in public communication internationally, even though many of these studies are hampered by questions of data access, selectivity and scale. Some of these questions have been touched on by the Automating Society Report 2020 (Chiusi, Fischer, Kayser-Bril & Spielkamp, 2020), which includes a section on Switzerland. Regarding science communication, however, hardly any studies on the role of platforms or platform providers, computational journalism or automated fact checking are available (Franzen, 2020). The few studies that exist focus on selected aspects of science communication like recommender algorithms on YouTube (Kaiser, Rauchfleisch & Córdova, 2021), social media portrayals of science in general (Hitlin & Olmstead, 2018; Zeng, Schäfer, & Allgaier, 2021) or specific topics like medical issues (Allgaier, 2020) or climate change (Allgaier, 2019), or

on the effects of social media on trust in science (Huber, Barnidge, Gil de Zúñiga & Liu, 2019). But hardly any of these studies focus on Switzerland specifically, partly due to the fact that social media communication is often not limited to individual countries.

Summary of Findings on Switzerland

Digital platforms are relevant – but for many, also less trusted – sources of information about science. About 77% of people in Switzerland get parts of their news diet online, while 44% get some news via social media such as Facebook, YouTube and WhatsApp (Newman, 2020). With regards to science-related content, YouTube is one of the most important online channels of contact with science and research, especially for the population aged 29 and under, while Facebook and WhatsApp only play a minor role (Science Barometer Switzerland, 2019). However, only 19% of the populations trust news encountered via social media, and 29% trust news they searched themselves online, compared to the 44% who trust the news overall (Newman, 2020). It remains unclear, however, how much this lack in trust applies to science-related content as well. *Scientific content plays a relevant role online:* According to the Science Barometer Switzerland (2019), 43% of people do look up scientific information (online and offline). Google Trends data offers one way to assess this using actual search data for Switzerland – even though many aspects of this data remain opaque and even though absolute numbers about search volume and reliable benchmarking are not available (Scharkow & Vogelgesang, 2011; Segev & Sharon, 2017). But when assessing search volumes in German-speaking Switzerland for the keywords "Science" [Wissenschaft], "Research" [Forschung], and "Technology" [Technologie], they are on par with "Politics" [Politik] and "Economy" [Wirtschaft] **(FIGURE 8)**, albeit they are considerably behind, e.g., "Sex" and "Sports" [Sport].

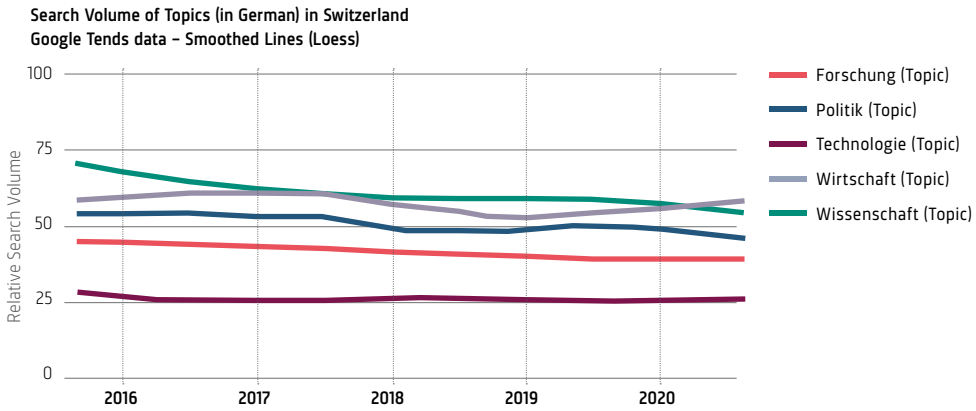

Figure 8: : Example of relative volumes of Google searches for (science-related) topics in Switzerland over the last five years, as aggregated and provided by Google Trends.

Digital platforms facilitate mis- and disinformation on scientific issues. Scholars describe technologies and technological agents as crucial for the spread of (alleged) misinformation through social networks, algorithmic selection and curation (e.g., Chan, Jones & Albarracín, 2017). YouTube in particular has been shown to not only host alternative and deviant content on science-related subjects (Allgaier, 2019, 2020), but also to recommend more such videos to users once they have come into contact with them (Chen, Nyhan, Reifler, Robertson & Wilson, 2020). Also on social media, social bots – programs or "social robots" that emulate human behavior and automatically create content in online environments – have often been described as manipulating public communication about science, but studies claiming to find such "social bots" based on off-the-shelf tools like "Botometer" have been shown to be flawed methodologically (Rauchfleisch & Kaiser, 2020). It remains unclear how relevant social bots are in science communication.

Digital platform architectures influence user perceptions and actions, sometimes with undesirable consequences for science communication. On the one hand, platforms like Google and Facebook and the drastic effects of their algorithmic content distribution lead to diagnoses of news consumption in an "echo chamber" of self-reaffirming views and opinions (Anspach, 2017; Bakshy, Messing & Adamic, 2015; Beam, Hutchens & Hmielowski, 2018). However, this diagnosis has been contested in recent studies, mainly from the field of political communication research, which highlight the concentration on a few news providers as the more prevalent problem (Haim, Graefe & Brosius, 2018; Jacobson, Myung, & Johnson, 2016; Schmidt et al., 2017; Trielli & Diakopoulos, 2019). For YouTube, however, studies show that far right user communities have formed around a limited set of politically extremist channels due to the video recommendation algorithm (Kaiser & Rauchfleisch, 2020), and studies on issues like climate change (Williams, McMurray, Kurz & Hugo Lambert, 2015) and vaccination (Schmidt et al., 2017) (albeit not for Switzerland) suggest that for such issues, polarized online communities may exist.

On the other hand, platforms provide an environment that is likely to affect the perception of science-related content: A large-scale study showed that the volume of exposure to online content on Facebook potentially affects people's moods and likely affects the kind of content they post themselves (Kramer, Guillory & Hancock, 2014). Other studies showed that the comments and other social cues such as likes and upvotes posted alongside the main content (e.g., articles on nanotechnology and drugs) bias readers' evaluation of the main content (Anderson, Brossard, Scheufele, Xenos & Ladwig, 2014; Winter, Brückner & Krämer, 2015).

Digital platforms offer opportunities for science communication. Several platform-driven mechanisms are likely to positively affect science communication (National Research Council, 2014). First, platforms have been linked to increased

political participation in the real world (Chan, 2016; Valenzuela, Bachmann & Bargsted, 2019). It remains to be seen whether this effect extends to engagement on science and research. Successful and largely online mobilizations around the "March for Science" or the "Fridays for Future" movements, both science-related and with considerable successes also in Switzerland, are examples of the potential of platforms for public engagement with science. Second, platforms make it easier to share and spread content. Combined with their algorithmic recommendations, this allows for content to go viral and be rapidly spread across many communities and countries. Researchers are trying to identify the characteristics that content needs to spread across different platforms (Goel, Watts & Goldstein, 2012; Heimbach, Schiller, Strufe & Hinz, 2015), and it seems that science content is among the content types that are more likely to produce viral content (Bright, 2016; Milkman & Berger, 2014). Third, platforms like Google not only collect and store but also give public access to data, which can be valuable both for researchers and interested individuals (Le Nghiem, Papworth, Lim & Carrasco, 2016).

5. How Science is Publicly Presented and Discussed in Switzerland

Many different representations of the natural sciences, the humanities and arts are available to the Swiss public – some of them originating in the country itself, many from abroad. These presentations include interpersonal communication, but also news media, online sources and social media, movies and TV shows, among others. This chapter describes which science-related content people encounter via these sources, paying particular attention to the sources most frequently used by the Swiss population.

5.1 Engagement Formats in Switzerland

Public engagement with science entails a direct interaction between scientists or scientific organizations and the public regarding a science-related object (e.g., an exposition or presentation). Such engagement formats have become a key component of science communication with the emergence of participatory and dialogical models of science communication in the 1990s (Fähnrich, 2017). Common formats are exhibitions and installations at museums, science centers and festivals, children universities, "Universities of the Age", science slams, science cafés and citizen science projects, as well as the more policy-oriented consensus conferences, participatory variants of technology assessments, citizens round tables, etc. (Einsiedel, 2014; Fähnrich, 2017). Alternative formats can take place online, such as participation in social media discussions, the contribution to crowdfunding projects or the participation in online citizen science projects (Dickel & Franzen, 2016). Scholars have distinguished "downstream" engagement, initiated top-down from scientists, scientific organizations or policy-makers, and "upstream" engagement which is initiated bottom-up from citizen initiatives, social movements, patient organizations and similar groups (Escobar, 2014).

WHAT IS THE EVIDENCE BASE FOR THESE QUESTIONS IN SWITZERLAND?

Amount of data	Quality of data	Published analyses
• very little data is available on the prevalence and importance of engagement formats in Switzerland	• data is mostly presented in "grey literature" and institutional reports, often highlighting specific formats or aspects only	• no published scholarly analyses on participatory formats of science communication in Switzerland

Switzerland harbors a wide variety of participatory formats and events. But there is a lack of data and reports that systematically describe and assess this diversity. Exceptions are reports by the Swiss Science Council (Bendix, 2017; Strasser & Haklay, 2018), a systematic review of extracurricular formats for children and adolescents to engage with STEM topics (Miller, Weidmann, Jacob & Paulsen, 2017), and a report on the diversity of citizen science projects in Switzerland (Science et Cité, 2015), while an online database tracking citizen science projects is being built (e.g., Citizen Science Center Zürich, 2019; Schweiz Forscht, 2020). Beyond these few sources, the best way to gather information on the frequency, characteristics and quality of participatory formats in Switzerland are the annual reports and overviews of various organizations regarding the science-related communication efforts they initiate or fund.

Summary of Findings on Switzerland

A variety of participatory and dialogical science communication formats are available to the Swiss public. They range from exhibitions over public lectures and numerous other events to citizen science projects.

Exhibitions

Exhibitions in museums, science centers, etc. offer infrastructures to engage the public with science. According to the Federal Statistical Office (2019d), Switzerland hosts more than 1100 museums, with about a third focusing on scientific topics (i.e., technology, history, natural sciences, and archaeology). Strongly frequented examples are the Swiss Museum of Transport in Lucerne (with 890.000 annual visitors), the Natural History Museum in Geneva (290.000), and the Swiss Science Center Technorama in Winterthur (267.000) (Federal Office of Culture, 2019).

Science Cafés

Science cafés invite citizens into restaurants, bars and cafés to discuss science-related topics with researchers (Science et Cité, 2020b). 2016 alone, the foundation Science et Cité organized 59 science cafés in 11 cities, bringing together 130 scientists and some 2.800 visitors (Science et Cité, 2016).

Citizen Science Projects

Citizen science is a format "where people produce scientific knowledge outside of traditional scientific institutions" (Strasser & Haklay, 2018, p. 22). This "production" ranges from collecting or categorizing evidence (online) to creating and conducting full-fledged research projects (Strasser & Haklay, 2018). At least 66 citizen science projects exist in Switzerland (Schweiz Forscht, 2020), most of them tied to disciplines such as biology and social sciences more generally (e.g., linguistics) (Science et Cité, 2015).

Citizen Workshops and Participatory Technology Assessment

Citizen workshops invite citizens to discuss and elaborate their views and concerns on complex scientific issues such as automation, robotics and gene editing. TA-SWISS and Science et Cité have been organizing annual citizen workshops in Berne and documented their results (e.g., TA-SWISS, 2019).

(Online) Talks & Presentations

Public talks and presentations, which differ in their degree of "multimodality, interactivity, performance, and event and entertainment orientation" (Niemann et al., 2020), are one of the most common formats of public engagement with science. Examples in Switzerland are lecture series by the Collegium Generale at the University of Bern, "Treffpunkt Science City" by ETH Zürich, or the "Interface Sciences-Société" at the University of Lausanne. In addition, the Swiss public can attend online talks in series like Science at Noon (Swiss Academies Of Arts And Sciences, 2020b) or Brain Snack (Science et Cité, 2020a), or in international formats like TED talks.

Online Engagement

Online channels enable the public to engage with science in novel ways (Dickel & Franzen, 2016), including on social media (Hargittai, Füchslin & Schäfer, 2018). Prominent channels are Twitter, which is also widely used by many scientists (van Noorden, 2014), YouTube, which is popular among younger audiences (Science Barometer Switzerland, 2019), and message boards like reddit, where discussions about topics like climate change are common.

Novel Formats and Tools

There are numerous novel participatory and engagements formats, such as science slams or "Fuck-up-Events" (presenting mistakes or failures), which combine aspects of science cafés, presentations and theatrical performances. Online tools like La moulinette (2020) or wissenschaftskommunikation.de (2020) help people to discover and incorporate the variety of such formats.

Formats for Children and Adolescents

Switzerland offers diverse formats for children and adolescents of all age groups to engage with science, often with an educational focus. Common formats range from guided tours, exhibitions, and workshops to labs, experiments and excursions, are well documented in reports and accessible through platforms like "Educamint" (Miller et al., 2017). Universities like ETH Zurich, but also research institutions like EMPA and CERN regularly run science camps where children and adolescents can engage with scientists over longer periods of time. Some camps, like "Camp Discovery" by Science et Cité and the Zurich Basel Plant Science Center, specifically encourage children who have not yet come into contact with science. Initiatives like «Science and You(th)» of Science et Cité give scientists the opportunity to hear students' perspectives, questions, concerns and recommendations for the science of the future (Science et Cité, 2020b). L'ideatorio at the University of Lugano regularly conducts Student Parliaments on topics like migration, vaccination or privacy (L'ideatorio, 2020).

Science Festivals

Science Festivals are large-scale events that aim to make science accessible and attractive to a broad public via formats such as public lectures, workshops, and science cafés. National science festivals took place in Switzerland in 2001, 2005, and 2009. Examples of recurring science festivals are "La Nuit de la Science" in Geneva, the "Scientifica" in Zürich, or the "Philosophy Days" in Biel. Other festivals like "Forschung live" of the SCNAT in 2015, or "Bern im All" in 2019 were unique public events.

Open Laboratories

Open laboratories invite the public into scientific laboratories to conduct their own research and experiments. Such laboratories, like the "Hackuarium" in Lausanne and the "GaudiLabs" in Lucerne, aim to democratize research and encourage accessible and low-cost scientific analyses (e.g., microbial analyses to track pollution). Academic public labs, like the "Scienscope" Labs of the University of Geneva or "L'eprouvette" of the University of Lausanne, also provide opportunities for participatory research by members of the Swiss public.

5.2 News Media Presentations of Science in Switzerland

A large amount of science-related news content is available to the Swiss public. Some of this content, typically domestically produced content, is tracked by Swiss institutions – like the content of SRG SSR which is tracked by the Federal Statistical Office (2019b). Other science-related content, e.g., the representations of science online, in films, series and TV shows that are distributed and watched in the country, stems from more diverse and predominantly international sources. This content is not tracked by Swiss institutions and considerably more difficult to assess. The Swiss population encounters science-related content in all these sources to varying degrees. The following subchapter assesses science-related content in news media. This includes (online) newspapers and magazines, television, and the radio. It assesses both the amount of science-related content in these media and how science is presented there.

WHAT IS THE EVIDENCE BASE FOR THESE QUESTIONS IN SWITZERLAND?

Amount of data	Quality of data	Published analyses
• comprehensive data available on the quantity of science-related content in print and online news, television, and radio in Switzerland; at least of the part that is produced domestically • a considerable portion of this data is not publicly available	• high quality and reliably sampled data are available	• considerable amount of published scholarly analyses are available for Switzerland • many use their own, sometimes topic-specific data

A considerable amount of data on the quantity and characteristics of Swiss news media coverage of science is available. While most older studies focused on print media (Eisenegger & Gedamke, 2013; Näf & Schanne, 2006a; Näf & Schanne, 2006b; Schanne, 1986), recent data from the Research Institute for Public Sphere and Society at the University of Zürich (fög) also considers online news as well as TV and radio news (Vogler & Schäfer, 2020a).

Beyond news, data are also available on the quantity of science and science-related topics in Swiss television and radio programming generally. A longitudinal monitoring of schedule and content of subsidized private radio stations in Switzerland captures „science, research and technology“ and “environment” as topical categories (Grossenbacher, Brändli, Sasso & Eichenberger, 2018; Grossenbacher & Sasso, 2014; Grossenbacher, Sasso & Glaab-Seuken, 2016). A similar monitoring of Swiss public TV captures „science, research and technology”, “nature, humans, environment” and “health” topics (Trebbe, Wagner, Fehr, Spittka, & Beier, 2015). In addition, the Federal Statistical Office tracks the annual

hours of "science" programming on national public television (Federal Statistical Office, 2019b), while companies like Mediapulse and WEMF own extensive data on broadcasting and print media. These data, however, do not provide insights into actual content beyond its quantity.

Additionally, a number of scientific publications are available for Swiss news media coverage about specific issues like mobile communication technology (Schanne, 2003), nuclear energy (Kristiansen, 2017), biotechnology (Bonfadelli, 2017b; Zimmermann, Aebi, Kolb, Shaw & Elger, 2019), climate change (Bonfadelli, 2017a; Oehl, 2015; Siegen, 2020), geothermal energy (Stauffacher, Muggli, Scolobig & Moser, 2015), communication science (Brantner & Huber, 2013), and on the appearance of scientists in Swiss media (Rauchfleisch et al., forthcoming in 2021). It is notable that most of these analyses focus on STEM disciplines.

While the quantity and general characteristics of science-related (news) content are well documented for Switzerland, and many specific issues have been analyzed, these insights are also limited in at least three aspects: First, there is a lack of qualitative studies that analyze portrayals of science and scientists in popular media formats, including edutainment programs as well as regular films and TV shows (e.g., Tintori & Palomba, 2017). Second, science-related media content from other countries such as France, Italy or Germany, that permeate the Swiss media market strongly (Künzler, 2013), is usually not included. Third, the quantity and characteristics of science-related content on the internet is almost impossible to assess adequately. While some reports have tried to analyze the science that is presented on social media (Hitlin & Olmstead, 2018), such analyses are time-, platform-, and language-specific and only scratch the surface of what the public encounters online (e.g., Ke et al., 2017).

Summary of Findings on Switzerland

Overall, science-related topics account for 1 to 3% of news media coverage in Switzerland. Between 2015 and 2019, science-related coverage accounted for 2.1% of the entire Swiss news media coverage (Vogler & Schäfer, 2020a). This varies by media type and by linguistic region, however: With 2,5%, the average is higher in French-speaking Switzerland and lower in the German- (1.9%) and Italian-speaking region (1.6%) (Vogler & Schäfer, 2020a). The proportion is highest in online news media with around 3%, around 2% in print media, 1.7% in public radio and television, and below one percent in printed tabloids and private radio and television (**FIGURE 9**). These numbers by Vogler and Schäfer (2020a) are based on a random sample of Swiss media content used in a yearly report assessing news media quality in Switzerland (fög, 2020a). 2.429 articles in this sample were categorized as "science-related" because their main focus was on science (instead of articles merely mentioning science in passing).

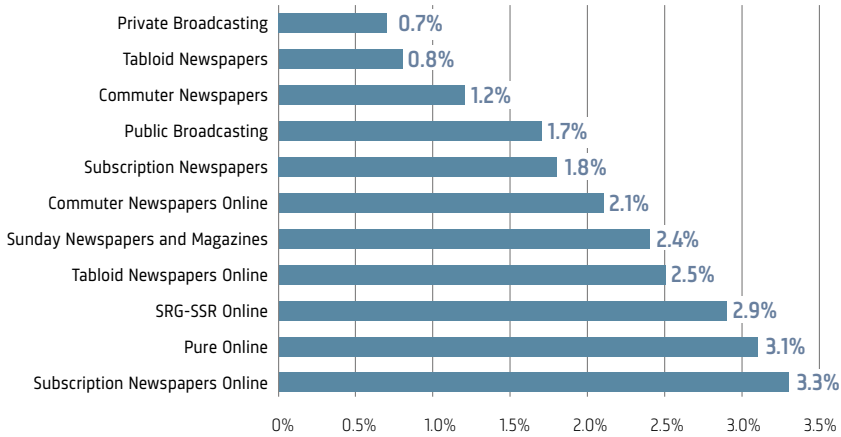

Figure 9: Proportion of science-related news coverage in Swiss media by media type. Sample: «Jahrbuch Qualität der Medien», 2015 - 2019, 66 media outlets, artificial week per year, manual content analysis

These findings are largely in line with older data on Swiss print media coverage, where science-related content accounted for 3.5% in 2005 (Näf & Schanne, 2006a, p. 63); with data on Swiss radio, where "science, research and technology" has a share around 5% (Grossenbacher et al., 2016; Grossenbacher et al., 2018; Grossenbacher & Sasso, 2014); and with data on Swiss public TV, where „science, research and technology" makes up about 2,5% of all coverage, "nature, humans and environment" about 3%, and "health" about 1% (Federal Statistical Office, 2019b; Trebbe et al., 2015). It also corresponds with international results which show that "science has never been a major media topic, with studies in the US, Australia, Germany and Greece, for example, finding between one and three percent of media coverage being devoted to science" (Schäfer, 2017a, p. 54).

The share of science-related coverage has increased in Switzerland in past decades. Although they focus on different media sources and employ slightly different understandings of science-related content, several studies have indicated a rise in science-related media coverage over time: Analyzing the 20 most covered annual news events between 1945 and 2013, Eisenegger and Gedamke (2013) show an increase of science-related topics, driven by debates around nuclear energy in the 1970s, biotechnology in the 1990s and 2000s, and by higher education and science politics from the mid-2000s onwards. In national public television, the annual hours devoted to "science" rose between 1998 and 2018, with a peak between 2009 and 2011 (FIGURE 10). The main reason for this increase, however, are re-runs of already aired TV programming (Federal Statistical Office, 2019b). Lastly, science-related coverage in a selection of Swiss print media grew from 1.8%

in 1982 to 3.5% in 2005 (Näf & Schanne, 2006a; Schanne, 1986). Internationally, an increase in science reporting has been shown in the US, Germany, Italy, the UK and Bulgaria (Bauer, 2012; for an overview see Schäfer, 2011). Notably, this growth of science coverage coincided with an intensifying crisis of science journalism in Switzerland and other countries **(SEE CHAPTER 3)**.

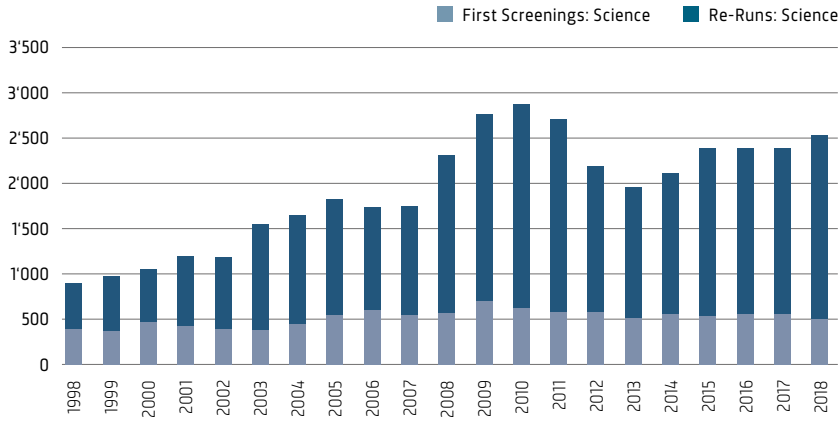

Figure 10: Annual hours devoted to the category "science" between 1998 and 2018 across all SRG SSR TV programming, incl. Euronews content

Science news coverage is less emotional, less focused on Switzerland, and (still) more contextualizing than news coverage on other topics; i.e., it rarely features interviews and opinion pieces, while its share of editorial contributions greatly varies by media type. Vogler and Schäfer (2020a) compared science-related news articles across time, between media types and with articles focused on other topics. They defined science-related news articles as articles where "science" is the core issue, no matter which resort they appeared in. Articles that were classified as other topics such as politics or economics might still feature some relation to science, e.g., quotes by a scientist. They showed that science-related news articles are less emotional on average (approx. 4%); about 90% are neutral, factual reports (rather than interviews and opinion pieces). Tabloids and online news contain more emotional reporting. Only about one third of science-related news articles refer to Switzerland – a proportion well above the 50% found for articles about politics, economics, and culture – while the editorial contributions by journalists vary strongly by media type: national public television and radio consist almost exclusively (approx. 90%) of editorial content, while about 50% of online news, 60% of commuter newspapers articles (e.g., 20 minutes), and 75% of tabloid articles were provided by news agencies.

Higher education institutions are represented in almost 2% of news media coverage in Switzerland – and their share is increasing. The overall share of news media coverage that mentions Swiss universities and universities of applied sciences rose from 1.2% in 2011 to 1.7% in 2017. Vogler and Schäfer (2020b) focused on the University of Zurich specifically and showed that its visibility also rose in Switzerland between 2003 to 2017 with an average share of 0.8%.

The arts and social sciences are prominently presented in Swiss media. They were the most prominent scientific disciplines appearing in Swiss news media already in the 1980s (Hutter, 2004 & Näf, 2004 cited in Näf & Schanne, 2006a). For the 2000s, Näf and Schanne show that the arts and social sciences made up over a third (35%) of science-related coverage, with STEM subjects accounting for 30% (Näf & Schanne, 2006b), and that the latter trended downwards since the 1980s (Näf & Schanne, 2006a). It is notable, however, that almost three quarters of all coverage about the arts and social sciences appear outside the media's science sections, a finding already reported in the 1980s (Näf & Schanne, 2006a, 63f.). For example, social scientists are likely to appear in the "domestic" section, while the arts and humanities are highly relevant in the "culture" section or "feuilletons". The prominence of the arts and particularly the social sciences as well as their appearance outside the science sections mirror findings from Denmark, Germany, Great Britain and the US (Albaek, Christiansen & Togeby, 2003; Elmer, Badenschier & Wormer, 2008; Summ & Volpers, 2016).

Only few individual scientists appear prominently in Swiss media – and among those, social scientists are the most prominent. An automated content analysis of the coverage of approximately 80 Swiss print and online news media in 2016 shows that 1.877 Swiss university professors (out of approx. 5.500 covered in the "proff.ch" database provided by swissuniversities at the time) were mentioned in the media. While most of them appeared only once, a group of 188 professors (equivalent to 3% of all professors) accounted for 50% of all news media mentions (Rauchfleisch & Schäfer, 2018). The professors with the highest average of news media appearances are political scientists and sociologists. Chemistry and veterinary science professors appear least often on average. The strong presence of the social sciences is linked to the presence of professors from different institutions: professors from the University St. Gallen, which has a strong economic focus, are most often presented in the media, followed by the social-scientific IHEID institute in Geneva (Rauchfleisch & Schäfer, 2018). During the COVID-19 pandemic and the heightened media focus on scientific and medical experts, these hierarchies between disciplines have changed considerably, however, with medical experts, epidemiologists and virologists taking center stage in Swiss media coverage (Eisenegger, Oehmer, Udris & Vogler, 2020).

5.3 Mis- and Disinformation: How Correct are News Media and Online Representations of Science?

Communicating scientific knowledge can be inaccurate on different levels: from omissions of relevant aspects or invalid interpretations over faulty simplifications to factual errors (Lehmkuhl, 2019). Depending on the intention of the communicator – if it is clear – these inaccuracies can be either mis- or disinformation: misinformation is information that is false but was not created with the intention of causing harm, while disinformation is false and was deliberately created to manipulate or harm others (Wardle & Derakhshan, 2018). For this report, we are interested in the frequency and degree of inaccuracies and do not discern between mis- and disinformation, as the intent of the communicator is often unclear.

WHAT IS THE EVIDENCE BASE FOR THESE QUESTIONS IN SWITZERLAND?

Amount of data	Quality of data	Published analyses
• little and circumstantial data available on the accuracy of science-related content in Swiss media • considerable amount of data available for online content on some topics	• data often limited to case-studies using small and sometimes biased samples	• considerable amount of published scholarly analyses available for international online content • only very few analyses on content produced in Switzerland

There are no overall assessments of the accuracy of scientific information in Swiss media. Beyond some examples of inaccuracies in scholarly literature (Crettaz von Roten, 2019), their accuracy can only be inferred through a study that identified the sources of science-related news articles (Eisenegger & Gedamke, 2013), as well as a study that measured the level of emotional language and the format of science news stories (Vogler & Schäfer, 2020a). Science-related quality- and fact-checking platforms like Mediendoktor.de and Medienwoche.ch have published critiques and quality assessments of individual articles from university press releases, news media articles as well as coverage of COVID-19 (e.g., medien-doktor.de, 2020). There are, however, analyses on the accuracy of science-related content on the internet – the domain where younger people in particular frequently encounter scientific information. Without focusing on Switzerland in particular, these studies attempt to determine how correctly scientific knowledge is communicated to the public and criticize any deviations. Recent studies looked at the accuracy of climate change videos on YouTube (Allgaier, 2019) or of health information online (Caulfield et al., 2019). These content analyses usually work with samples of content on a specific topic within a specific online channel and often do not differentiate between different communicators who might have different motives. They are, therefore, limited in scope, but nonetheless allow for plausible wider conclusions.

Summary of Findings on Switzerland

News media reporting on science can be considered mostly accurate but vulnerable to biased framing. No definitive analyses assess the factual accuracy of science news reporting in Switzerland. However, a number of indicators suggest that news media reporting is rather accurate. A long-term content analysis of scientific articles in Swiss print media shows that most of the reporting directly feeds of professional university press releases or, in rarer instances, represents critical reporting by science journalists (Eisenegger & Gedamke, 2013). Vogler and Schäfer (2020a) showed that science news articles from 2015 to 2019 rarely used formats such as opinion pieces and interviews and that emotionally charged articles appeared in less than 5% of articles. Studies from other countries showed that most mistakes in science news reporting originate from quoted sources – something that likely applies to Swiss media, and has potentially increased due to the worsened working conditions of Swiss (science) journalists nowadays (SEE CHAPTER 3).

Figure 11: Popular Swiss tabloid (Blick) and broadsheet (Neue Zürcher Zeitung) reporting on a preliminary in-vitro study on their respective online platforms.

On the flipside, it is just as plausible that science news reporting in Switzerland is susceptible to be inaccurate with regards to faulty interpretations and omissions of relevant aspects. First, the aforementioned prevalence and rise (Vogler & Schäfer, 2020b) of university press releases in science news reporting in Switzerland is paired with general research findings that research institutions tend to sensationalize their findings (Sumner et al., 2016). In addition, a rising influence of PR on science-related reporting, that has been shown repeatedly in other countries, has been demonstrated for Switzerland as well (Vogler & Schäfer, 2020b). Second, media channels such as tabloids and online news platforms are more likely to feature inaccuracies. Sensationalizing as well as framing as an emotional story were shown to be the main content-related characteristics that help science news stories to be more widely spread online (Milkman & Berger, 2014). As a result, examples as depicted on the left-hand panel in Figure 11, which feature both inaccurate facts and interpretations are rare but exist in news media. Less evidently, the right-hand

panel in Figure 11 has also been criticized by medien-doktor.de for containing small factual inaccuracies and for failing to report conflicts of interests and expert opinions on the reported study (medien-doktor.de, 2020).

The internet is the most likely source for the Swiss population to encounter inaccurate scientific content. Structurally, the internet is most likely to feature inaccurate content because professional curation and quality control are often absent and various communicators with different agendas can directly communicate with the public, either by producing content or by commenting on available content (Brossard, 2013). The consequences of such structures are best documented for topics like climate change (Koteyko, Nerlich & Hellsten, 2015) and health or medical topics (Caulfield et al., 2019): Studies have shown that online communication on climate change in English-speaking countries sometimes deviates significantly from the state of scientific knowledge (Allgaier, 2019; Gavin & Marshall, 2011) and how climate change denial communities strategically connect and push their agendas on platforms like Facebook (Bloomfield & Tillery, 2019) and Twitter (Williams et al., 2015). Similarly, health-related information online and in social media (e.g., Madden, Nan, Briones & Waks, 2012; Scullard, Peacock & Davies, 2010) has been shown to be inaccurate to a considerable degree.

YouTube contains a considerable amount of inaccurate and potentially harmful information, while being one of the most relevant sources of science-related content in Switzerland. YouTube is one of the most relevant online sources where (particularly younger) people encounter science-related content (Science Barometer Switzerland, 2019). While there are no large scale studies that analyze the accuracy of science-related information in YouTube videos, individual studies highlight problematic topics: Kaiser, Rauchfleisch and Córdova (2021) showed that Brazilian YouTube hosts mostly accurate information on the Zika virus, but that many users are likely to encounter some faulty and potentially dangerous misinformation. Allgaier (2019) categorized 200 videos by combining the 20 most relevant videos for a total of 10 search terms related to climate change. He found that videos on search terms like "climate change" and "global warming" were mostly produced by media corporations and generally in line with the scientific consensus. Search terms like "geoengineering" and "fracking", however, "largely led to videos that confront the users with positions that challenge mainstream scientific positions on climate change, or to outspoken conspiracy theories about so-called 'chemtrails'" (Allgaier, 2019, p. 10). YouTube videos on other science- or health-related topics also contained considerable inaccuracies (Allgaier, 2020). And while these inaccurate videos are often in the minority, they are particularly dangerous in the health-domain, as they often hijack scientific terminology and use testimonials to strategically get their message across (Caulfield et al., 2019). Unfortunately, these messages are sometimes unproven (Hawke et al., 2019), or even harmful treatment recommendations (e.g., Unispital Basel, 2020).

PANDEMIC COMMUNICATION: ONLINE AND OFFLINE CONTENT ON COVID-19

Information accuracy has become even more relevant during so-called "infodemics", i.e., times of an epidemic like COVID-19, when people are actively looking for information but are confronted with information that varies strongly in quality, is sometimes strategically misleading and has considerable public health implications (Working Group on Infodemics, 2020; World Health Organization, 2020). It seems that most of the findings on the accuracy of science-related content are echoed in studies of online and offline communication around the COVID-19 pandemic.

Regarding Switzerland, Zurich-based Research Institute on the Public Sphere and Society (fög; Eisenegger, Oehmer, Udris and Vogler (2020) assessed a large sample of Swiss news coverage on COVID-19, using manual and automated content analyses. Using quality criteria derived from deliberative public sphere theory, they concluded that the overall quality of COVID-19-related news in Switzerland is good. It was shown to apply a larger societal perspective, to not exaggerate the characteristics and implications of the pandemic and to be in line with the number of new infections quantitatively. Particularly at the beginning of the pandemic, the medical perspective played a major role and scientific and medical experts were often featured. The study criticized that coverage often failed to contextualize statistics and relied on a limited number of scientific sources only, often overlooking insights from disciplines other than medicine.

The few studies analyzing online content classified up to one quarter of all posts on COVID-19 on social media as misinformation (e.g., for Twitter: Kouzy et al., 2020). For Twitter content originating from Switzerland, however, misinformation around COVID-19 was deemed a minor issue (Rauchfleisch et al., 2020). To further investigate this online misinformation, a report by the Reuters Institute for the Study of Journalism at the University of Oxford (Brennen, Simon, Howard & Kleis Nielsen, 2020) analyzed "225 pieces of misinformation rated false or misleading by factcheckers" regarding COVID-19 on social media platforms such as Twitter, Facebook and YouTube, almost all of them in English. They showed that approximately 60% of these posts used misleading language and contextualization, thus being "reconfigured" (rather than completely fabricated) misinformation, and that these "reconfigured" posts accounted for about 90% of social media interactions (i.e., likes, shares or comments). They further showed that only 20% of these posts originated from prominent public figures, such as politicians and celebrities, but that these persons misinforming posts accounted for about 70% of all social media interactions. In addition, the report showed that YouTube and Facebook had taken down or flagged approximately three quarters of the problematic posts, while Twitter had only flagged or removed 41%.

6. Recommendations for Science Communication and Public Engagement with Science in Switzerland

Based on the comprehensive assessment of the status quo of science communication and public engagement with science in Switzerland presented in the previous chapters, the expert group formulated recommendations on how to improve science communication in Switzerland. Apart from the status quo assessment, these are based on expert group discussions, a stakeholder workshop on science journalism, conversations with external stakeholders and recommendations by similar expert groups in the US, in Germany, and on the European level. The recommendations are presented in this chapter:

1 Science communication and public engagement should become an accepted part of scientific culture and practice.

Many scholars in Switzerland are willing to engage in public communication and dialogue. The number of scholars actually engaging in such activities is considerably lower, however. Studies suggest that social and cultural factors in the scientific community – e.g. lacking incentives or critical perceptions of peers – hinder communication and engagement activities.

Therefore, higher education institutions, scientific organizations and research funders should improve the recognition and valorization of public communication among scholars. This should include symbolic incentives like awards. It should also include 'harder' incentives: While not all scientists should be forced to communicate to the public, communication activities should be taken into account positively when possible, e.g., in funding decisions, the recruitment of researchers or their evaluation.

2 Training in science communication and public engagement should be part of scholarly curricula, especially for young scientists.

The gap between many scholars' willingness to engage in public communication and their lack of actual engagement is also related to a lack of training in science communication. Such training – which should cover both the conceptual basis for science communication and the evidence underlying it as well as practical exercises in how to communicate with journalists or on social media – should be encouraged and intensified.

Higher education institutions, scientific organizations and disciplinary associations should offer and reward training in science communication and engagement, e.g. on dialogue formats, social media or stakeholder communication. Where possible, such training should be embedded in higher education cur-

ricula and in the education of young scholars. Higher education institutions, scientific organizations and disciplinary associations, potentially together with high-level organizations like the Academies of Arts and Sciences or swissuniversities, should also provide resources to train the trainers in the field of science communication. They should use communicating scientists as role-models and follow best practices in science communication and public engagement.

3 Scientists engaging in public communication should be offered professional as well as social, psychological and, if necessary, legal support.

Research shows a pluralization of public communication about science, science-related issues and technologies such as climate change, vaccination, animal experimentation, GMOs, or 5G. At times, this results in personal attacks on scholars communicating publicly on such issues, particularly on female scholars. In these situations, the respective scientists need to be supported by their organizations and by the scientific community. Currently, few such support systems are in place in Switzerland.

Higher education institutions, scientific organizations and disciplinary associations should build up capacities to assist communicating scientists. They should also build up capacities to support scholars, including whistleblowers, in critical and conflict situations. This pertains to professional support in communication (i.e. providing science communication toolkits for scientists, familiarizing them with social media and stakeholder communication, or assisting them in navigating crisis communication). It should also include social and psychological support from peers, mentors and supervisors. Importantly, it should include legal support if necessary.

4 Scientists' understanding of public perceptions of science and the role of science in society should be improved.

Research shows that scientists, the public, political decision-makers and stakeholders have different perspectives on what they consider important and of value to society. In order to facilitate a fruitful dialogue between science and society, scientists and scientific organizations need to be aware of differing perspectives on their work and results, and of the views, concerns, expertise and needs of the public, of decision-makers and stakeholders.

Higher education institutions, scientific organizations and disciplinary associations should organize trainings, workshops and forums involving scientists as well as stakeholders and representatives of the public in order to 'listen' to society's perceptions, visions, concerns, and priorities for research. Those should include, and be co-constructed with, social actors such as NGOs, patient organizations, interest groups, trade unions, social movements etc.

5 Scientists and scientific organizations should understand and employ evidence-based science communication and public engagement.

Research on science communication and public engagement has existed for decades and has grown considerably in recent years. It has shown the strengths and weaknesses of different types of science communication, identified diverse audiences and the best ways to engage with them. This body of evidence should be taken into account in the planning and practice of science communication and public engagement activities.

Scientists engaging in public communication, science communicators and scientific organizations should be aware of research on science communication and its findings. Therefore, research on science communication, particularly on the Swiss context, should be regularly surveyed, compiled and communicated into the scientific community. Higher education institutions as well as scientific associations should offer courses on this research and embed them in their curricula. Connectedly, science communication activities should be evaluated systematically wherever possible, assessing both desired and detrimental effects. The results should be publicly accessible in order to broaden the evidence base of science communication.

6 A dialogue about the aims and norms of science communication and public engagement is necessary.

Science communication and public engagement can pursue different aims. For example, it may serve primarily to disseminate knowledge, to start a dialogue with the public, or to strategically heighten the reputation of individual scientists, disciplines or organizations. Some of these aims (like the primary orientation on individual or institutional reputation-building) and some of the means (like using strategic framing to persuade audiences) have been criticized, and their limits shown by empirical studies. Therefore, scholars as well as scientific associations have called for an ongoing dialogue within and beyond the scientific community about the aims and norms of science communication and public engagement.

High-level organizations in the scientific community – such as the Academies of Sciences and Arts or swissuniversities – should take charge on these questions. They should establish regular exchanges about the aims and norms of science communication and public engagement.

7 Scientists and scientific organizations should communicate how science works, including uncertainties, different perspectives, and relevance to society.

Scientific knowledge is constantly expanding and evolving. It is the process of discovery of what is known, under a specific set of conditions and time. There are limitations to studies and uncertainties in scientific findings that need to be communicated effectively to the public. Scientists and their institutions should provide a balanced view of the evidence and communicate what and why uncertainty exists. This requires acknowledging different perspectives and interpretations of scientific evidence.

Higher education institutions, scientific organizations and research funders should encourage scientists to communicate not only the findings of their work, but also the research processes, methods as well as the uncertainty of findings. In research applications, scientific publications and publicly, scientists, research organizations and funders should communicate the (potential) social relevance of science, including the relevance to taxpayers and beneficiaries of their work, without overstating it.

8 Encourage science communication and public engagement with underserved audiences.

Research shows that segments of the population have different degrees of access to science, and are not equally interested in or informed about science and research. Science communication and public engagement should specifically address publics who are not engaged in science-related discussions. This is also true for geographic regions in which fewer places to engage with science and research are available.

Science communication and engagement activities by individual researchers, scientific organizations and other science communicators should more strongly address underserved audiences and regions. Research funders should specifically encourage scientists to do so and provide funding programs for such activities.

9 Support participatory research initiatives.

Society not only benefits from science, but also from actively participating in science. Formats like citizen science, participatory (action) research, and community-based research are increasingly recognized as important for understanding research, but also for increasing the social impact of science. Involving

publics in science, from planning studies through communicating their findings, should be of higher value in Switzerland, embracing a more equal instead of a top-down approach to understanding and solving problems.

Research funders should include participatory research as a legitimate option, and scholars should include citizens more in their research. This requires both prioritizing a stronger collaboration between science and society, but also providing training for researchers to better involve members of the public. Institutions and scientists should create efficient and effective structures for sharing opportunities for the public to be involved in science. Science journalists should be encouraged and incentivized to communicate outcomes and processes of such initiatives, highlighting the important role science and society have together in a democratic society.

10 Institutional and individual science communication should express the specific values of science.

Science communication and public engagement with science must develop strategies that enable individual researchers, but also institutions of higher education, research institutions and expert committees to be viewed by the public as fundamentally different institutions than companies and administrations. This may lead to a better understanding of science in politics and the larger public and preserve academic freedom, autonomy and its innovative power.

Scientific organizations and higher education institutions should have clear guidelines that define their specific values and communicative ethics, and describe how these values and principles translate into communication and engagement. In addition to internal guidelines within organizations, overarching guidelines for science communication and public engagement would be helpful. These should be jointly developed by high-level scientific organizations like the Academies of Sciences and Arts or swissuniversities, researchers, scientific organizations, research funders, communication experts and members of the public.

11 Institutional science communication should be carried out and coordinated in-house.

Institutional science communication should, whenever possible, be carried out in-house and not by private sector communication agencies, to ensure that communicators have sufficient knowledge of the specific conditions of scientific institutions and can establish trust with the researchers they support.

Communication departments of higher education and scientific institutions should offer in-house courses and provide best practices to get in touch with researchers internally. Social Media trainings and a monitoring and regular exchanges about the posts and tweets on social media could be organized in order to improve knowledge about social media and media activities.

12 Research on science communication in digital environments should be fostered through funding opportunities, data access and capacity building.

There is considerable research on science communication in digital environments, e.g. on social media communication about science, science journalism online, participatory online formats, or individual scientists' online communication. But there are still considerable gaps, e.g. about the consequences of science communication in digital environments for stakeholders like politicians, about the validity of available data on digital science communication or about the audiences of science communication in digital environments. These gaps are partly due to missing funding opportunities, problems with data access and a general lack of capacity building.

There should be more large-scale funding opportunities for projects tackling the above-mentioned research gaps, e.g. National Research Programs (NRPs). Capacity building can be addressed by establishing long-standing centers or "leading houses" for science communication research in Switzerland. Platform providers should establish clear standards and interfaces for publishing data or for giving access to researchers. This needs to be accompanied by the establishment of appropriate laws and regulations in the Swiss and European context.

13 Science communication needs to counteract mis- and disinformation.

Inaccurate information about science-related topics is prevalent online, in social media and messaging services, whether distributed strategically or inadvertently. The spread of mis- and disinformation is often enabled by uncertainty inherent in scientific results and public controversies which can open up room for faulty interpretations. This constitutes a problem for science communication.

Platform providers and legacy media should cooperate with researchers to implement findings on how to detect and counteract mis- and disinformation. Scientists should conduct interdisciplinary research, especially between computer science and social science, to develop tools, surveys or communicative strategies to identify and counteract mis- and disinformation. Research from the social and behavioral sciences on inoculating citizens against mis- and disinformation and on the pre- and debunking of false information should be included in science communication strategies.

14 Science communication and public engagement with science should consider and reflect the diversity of science.

Science is diverse in terms of disciplines and research fields, but also in the seniority of researchers, their age, gender and geographic origin, among other factors. Yet science communication and public engagement with science often do not reflect this diversity. Studies show that certain disciplines, senior scientists and men are most strongly represented. Where possible and appropriate, science communication and public engagement should be more diverse.

Scientific organizations and higher education institutions should train, encourage and incentivize researchers from disciplines or with sociodemographic characteristics who are less visible publicly to engage in communication and public engagement.

15 Communication between science and politics needs to be strengthened and institutionalized.

Scientific expertise and knowledge must be made available to federal, cantonal and local authorities and political decision-makers to help them make decisions based on scientific evidence. In doing so, the respective roles and responsibilities of science and politics needs to be mutually understood and accepted, which requires regular exchanges and trust. The Swiss research landscape should define a clear point of contact for authorities and policy-makers.

In times of crisis, a scientific committee should be established quickly and enable a consultation with top researchers in accordance with good governance rules. In normal times, there must be regular exchanges between national, cantonal and local policy-makers and science, so that trust can be established. For this, topics relevant to society must be covered as much as possible by scientists and scientific institutions in Switzerland. This should move Switzerland towards more evidence-based regulations, policies, and recommendations, and make the country even more innovative, efficient, and effective in all areas.

16 A new funding infrastructure for science journalism is needed, which should fund innovative projects and core infrastructures.

Research has documented the challenges science journalism is facing in Switzerland. The economic sustainability of science journalism in Switzerland is compromised and working conditions for science journalists have deteriorated. These challenges affect specialized science journalism in traditional media houses as well as freelancing science journalists. New organizational and business models in science journalism have emerged, but their economic sustainability is not yet clear.

Therefore, a new infrastructure is needed to support science journalism. It should pursue a twofold aim: Based on an application system and competitive decision-making by an independent board of peers, it should provide funding for innovative projects in science journalism, from individual journalistic products by individual journalists to start-up funding for science-related outlets. In addition, it should provide long-term funding for critical infrastructures that maintain core functions of science journalism in Switzerland. Institutionally, such a funding infrastructure could be organized as a foundation. It should be able to incorporate funding from different sources, including, but not limited to, funding from scientific organizations and corporations, public funding or philanthropic funding. Funding sources should be as diverse as possible, and the independence of decision-making from funders' influence should be secured.

17 Science journalism in public service broadcasting and established media houses should be strengthened, and networked across desks.

Science journalism has proven its value during the Covid-19 pandemic, but also with regard to other political, economic and societal issues (including, but not limited to 5G, climate change and biodiversity). But the number of science journalists and science desks in Swiss media houses is shrinking. Specialized science journalism only exists in a small number of media houses nowadays, e.g. at public service broadcaster SRG and commercial media houses CH Media, NZZ or TX Group. Given its crucial role, science journalism needs to be strengthened in Swiss media houses. A base level of science journalistic expertise is also necessary for media houses to make optimal use of existing support infrastructures like the international Science Media Centers or aggregators of science-related media releases like EurekAlert.

Both public service and commercial media houses should refrain from (further) layoffs of science journalists, and maintain and strengthen the science journalistic expertise among their staff instead. Science journalists should be represented in newsrooms and editorial board meetings. Exchanges between science journalists and other journalists should be furthered, to provide science-related expertise for non-science desks and, in turn, inform science journalists about novel angles to report on science and to connect their reporting to political, economic and societal issues. Media houses without a dedicated science desk should integrate science journalists in other desks, and encourage them to work across desks as cross-sectional teams.

18 A national science news provider is needed to serve Swiss media houses.

Few Swiss media houses have science desks anymore, and regional and local media in particular often lack science-related expertise. In addition, the working conditions of the remaining science journalists have worsened. Time constraints and an increasing in-house demand for short science-related news are making it more difficult for many science journalists to engage in comprehensive background reporting.

Switzerland needs a provider that offers science-related news to media houses to remedy these problems. Such a provider should be staffed with science journalists and focus particularly on the production of short news, e.g. about new scientific findings, which are often produced independently in various media houses yet show little variety with regard to content across these media. The existing science news channel at Keystone-SDA could function as such a provider, as it is already set up, works multilingually and has established channels for content distribution. Its service should be maintained, ideally strengthened, and if necessary, its funding model should be modified to ensure economic sustainability. In case Keystone-SDA is no longer able to fulfil its function in the future, the creation of an alternative science news service as a successor is mandatory.

19 Financially support and foster the independence of freelancers.

Freelancers are particularly important in science journalism – because science is a highly specialized, expert system that requires specialized journalists to report on it, and because fewer such journalists exist in traditional media houses. But the situation of many freelancing science journalists has become precarious in recent years. The fees for their work have dropped, as has the number of media being able to finance their services. Many freelancers have to produce more content to accumulate a decent monthly income, leaving them less time per story.

The work of freelancing science journalists should be incentivized and valorized more. Both public service and commercial media houses should pay adequate fees, keeping in mind that the published length of commissioned articles or pieces may not represent the amount of work that went into them. Finding suitable freelancers should be simplified for media houses, e.g. via a database that allows media houses to book freelancers with experience on certain scientific topics. Financial support should be provided for freelancers, for example by using a novel funding infrastructure to provide additional fees for freelancers' work.

20 Innovation in science journalism in Switzerland should be furthered.

In Switzerland, only few examples of innovative digital formats in science journalism exist – like interactive multimedia stories, visual storytelling or specialized social media formats. A stronger emphasis on innovation in Swiss science journalism is necessary to optimize its appeal to audiences, particularly to young audiences.

Science journalism, both when focusing on basic science and when providing input on societal issues, has a strong potential for innovative content, narratives and formats. Such innovative forms could lend themselves particularly well to attracting younger audiences. Therefore, science journalists should be encouraged to use this potential. Journalism schools should offer training in such formats, and media houses should encourage and enable their journalists to attend them. Additional incentives like awards for innovative science journalism are needed. Funding opportunities should be established to support innovative approaches and formats of science journalism, and media legislation should aim to foster digital formats in (science) journalism as well.

7. Appendix

7.1 Members of the Expert Group

- **Prof. Dr. Mike S. Schäfer (Speaker)**, University of Zurich, Communication Scientist, Expert for Science Communication, Co-Leader Science Barometer Switzerland
- **Gian-Andri Casutt (Co-Speaker),** ETH-Board, Head of Communication, President of EUPRIO – European Association of Communication Professionals in Higher Education
- **Prof. Dr. L. Suzanne Suggs (Co-Speaker),** Università della Svizzera italiana, Communication Scientist and Expert for Health Communication, Vice-President of Swiss School of Public Health
- **Prof. Dr. Karl Aberer,** EPFL, Computer Scientist, Head of Distributed Information Systems Laboratory and Expert in Data Science and Engineering for Social and News Media
- **Dr. Philipp Burkard,** Foundation Science et Cité, Berne, Managing Director, Board of European Science Engagement Association (EUSEA)
- **Dr. Ana Godinho,** CERN, Geneva, Head of Education, Communications and Outreach»
- **Prof. Dr. Caspar Hirschi,** University of St. Gallen, Historian, Expert on Role of Experts and Intellectuals in Society
- **Dr. Angelika Jacobs,** University of Basel, Scientific Communications Officer, Communications & Marketing, Board Member of the Swiss Association for Science Journalism
- **Prof. Dr. Otfried Jarren,** University of Zurich, Communication Scientist, President of Swiss Federal Media Commission (EMEK)
- **Prof. Dr. Alain Kaufmann,** University of Lausanne, Sociologist, Head of The ColLaboratory
- **Prof. Dr. Reto Knutti,** ETH Zurich, Climate Scientist, Head of ProClim Forum for Climate and Global Change, Science Communicator
- **Prof. Dr. Michaela Maier,** University of Koblenz and Landau (D), Communication Psychologist, Expert for Science Communication and Effects of Online Communication
- **Prof. Dr. Julia Metag,** University of Münster (D), Communication Scientist, Expert for Science and Digital Communication, Co-Leader Science Barometer Switzerland
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- **Prof. Dr. Bruno Strasser,** University of Geneva, Historian of Science and Technology, Head of the Bioscope, Public Outreach Lab for the Life Sciences
- **Prof. Dr. Albert Weichselbraun,** University of Applied Sciences of the Grisons, Information Scientist, Expert for Digital Technology, Natural Language Processing, Media Monitoring

7.2 Expert Group Coordinators

- **Dr. Tobias Füchslin,** Swiss Academies of Arts and Sciences
- **Salome Bosshard,** University of Zurich

7.3 Reviewers for the Status Quo Report

- **Prof. em. Dr. Heinz Bonfadelli,** University of Zurich
- **Prof. Dr. Fabienne Crettaz-von Roten,** University of Lausanne
- **Prof. Dr. Adrian Rauchfleisch,** National University of Taiwan, Taiwan
- **Prof. Dr. Hannah Schmid-Petri,** University of Passau, Germany

7.4 Experts who Provided Information or Feedback for the Report

- **Prof. Dr. Silke Adam,** University of Bern
- **Prof. Dr. Joachim Allgaier,** RWTH Aachen University
- **Claudia Appenzeller,** Swiss Academies of Arts and Sciences
- **Dr. Rachel Aronoff,** Hackuarium
- **Dr. Maïa Berman,** Swiss Institute of Bioinformatics
- **Dr. Mirko Bischofberger,** Swiss Federal Institute of Technology Lausanne
- **Dr. Beate Böckem,** Zurich University of Fine Arts
- **Dr. Elisabeth Ehrensperger,** TA-SWISS
- **Filip Dingerkus,** Zurich University of Applied Sciences
- **Silke Fürst,** University of Zurich
- **Dr. h. c. Beat Glogger,** higgs.ch
- **Prof. Dr. Thomas Hanitzsch,** Ludwig Maximilian University of Munich
- **Dr. Tobias Keller,** gfs Bern
- **Dr. Sabrina Kessler,** University of Zurich
- **Dr. Benedikt Knüsel,** State Secretariat for Education, Research and Innovation
- **Christoph Leuenberger,** ETH Board
- **Dr. Mirko Marr,** mediapulse - Corporation for Media Research
- **Dr. Giovanni Pellegri,** University of Lugano
- **Prof. em. Dr. Stephan Ruß-Mohl,** University of Lugano
- **Mirco Saner,** Zurich University of Applied Sciences
- **Michael Schanne** Zurich University of Applied Sciences
- **Prof. Dr. Andrea Schenker-Wicki,** University of Basel
- **Stephanie Schnydrig,** Keystone-SDA
- **Isabel Sörensen,** University of Zurich
- **Dr. Ruxandra Stoicescu,** Swiss Network of International Studies
- **Volker Stollorz,** Science Media Center Germany
- **Dr. Daniel Vogler,** University of Zurich
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