SCIENCE ORGANIZATIONS IN THE DIGITAL AGE
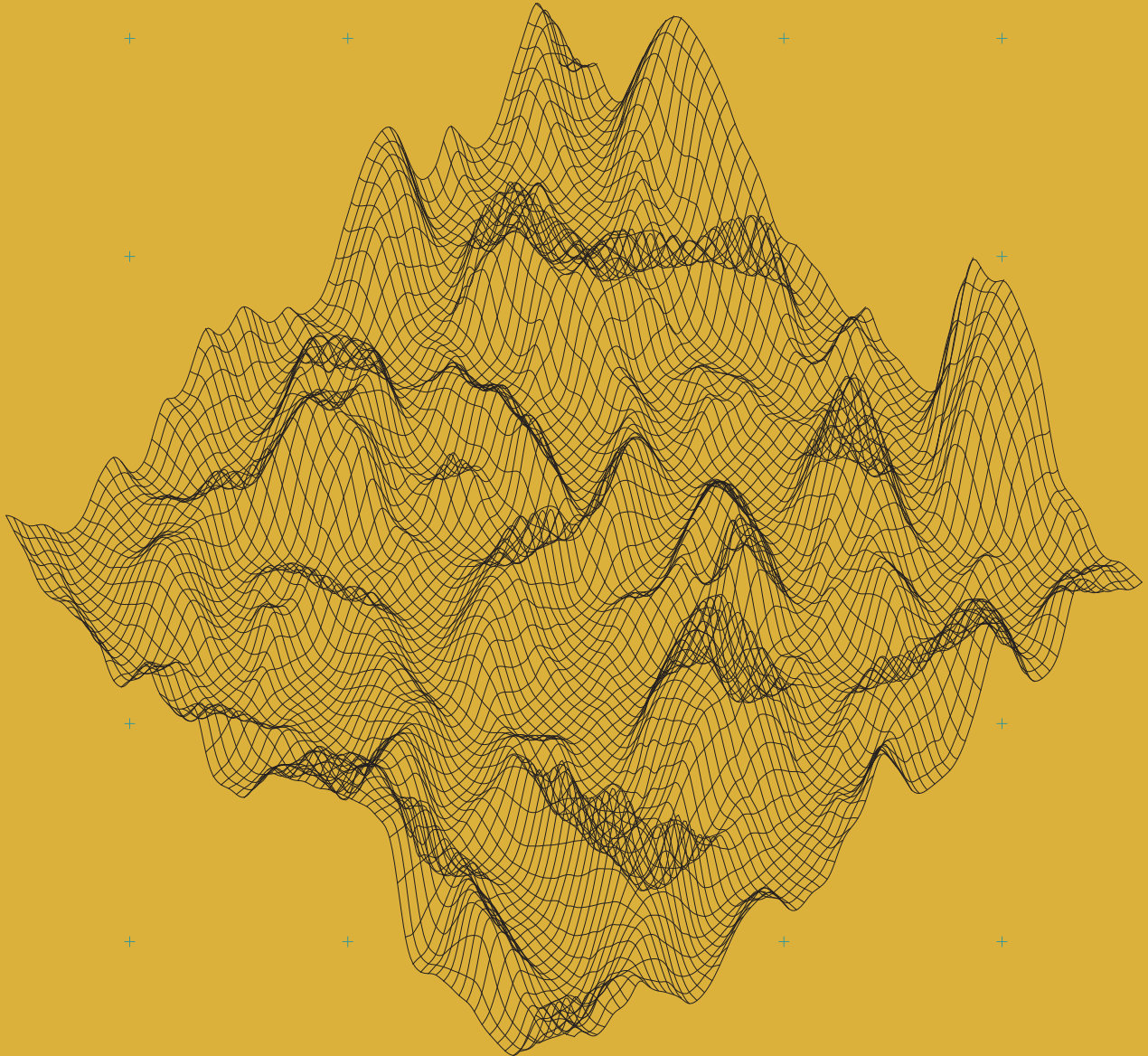
A series of digital journey case studies
with Members of the International Science Council

International
Science Council
The global voice for science

About the International Science Council

The International Science Council (ISC) works at the global level to catalyse and convene scientific expertise, advice and influence on issues of major concern to both science and society.

The ISC is a non-governmental organization with a unique global membership that brings together more than 245 international scientific unions and associations, national and regional scientific organizations including academies and research councils, international federations and societies, and young academies and associations.

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Preface

In 2022, the Secretariat of the International Science Council (ISC) embarked on a transformative digital journey. This initiative emerged from an understanding of the urgent need for an inclusive, globally-oriented membership organization to adapt to the digital transformations reshaping our professional, recreational, and daily lives across diverse communities worldwide. Initially conceived as an exercise for the communications team aimed at enhancing the ISC's digital skills and capacity, the project quickly evolved to focus on ensuring agility in adapting to the ever-changing digital landscape. Importantly, the ISC sought to involve its Members in this journey, understanding that the strength of the ISC is intrinsically linked to the robustness of its membership. A survey of the Membership led to identifying several relevant case studies where ISC Members' learnings and journeys could be shared with others.

This report delves into the multifaceted concept of 'digital' – a term that has evolved significantly over time, influencing both technological and cultural aspects of organizations. The ISC's exploration begins with the fundamental question: What does 'digital' mean in the context of scientific organizations? This question was posed to a diverse group of staff and Members during ISC workshops in late 2022, resulting in a spectrum of interpretations that range from the use of online tools for enhanced connectivity, to a broader, all-encompassing view of digital as integral to living in the 21st century.

In this document, we adopt the latter perspective, enabling an examination of the myriad ways in which digitalization is reshaping the activities and methodologies of ISC Members and Affiliated Bodies. The ISC's focus is on the transformative impact of digital technologies on scientific organizations, highlighting both the opportunities and challenges this presents.

Central to these findings is the survey conducted in early 2023 from diverse ISC Membership organizations, including national academies, unions and the Affiliated Bodies. The survey was not designed as a rigorous scientific study but rather as a barometer to gauge the digital engagement and capacities of ISC Members. It provided a platform for identifying Members with intriguing results or comments, who were then interviewed for further insights. These interviews culminated in the presentation of case studies at the ISC Mid-Term Members' Meeting in May 2023.

The case studies presented in this report are a testament to the innovative digital strategies employed by ISC Members. They exemplify how digitalization can be leveraged to create deeper connections, generate value in novel ways and transform organizational structures and operational models. From the Royal Society's Search Engine Optimization (SEO)-focused content strategy to the Global Young Academy's member-centric approach, these insights offer a glimpse of the dynamic digital landscape within scientific organizations.

This report explores the key areas of opportunity – creating deeper digital connections, generating new value and evolving organizational models – and aims to inspire ISC Members and other science organizations in their digital transformation journeys. It explores how digitalization is not just about adopting new technologies but also about embracing a cultural shift that redefines how scientific communities connect, collaborate and create value.

The ISC would like to continue this conversation with its Members throughout 2024 and beyond, as it navigates the explosion of large language models and other generative artificial intelligence (AI) tools and the opportunities and threats they present, in day-to-day work and for society at large.

The ISC extends its heartfelt gratitude to all the Members who participated in the survey and contributed to the case studies. Their insights and experiences are the cornerstone of this report, providing valuable perspectives on the digital journeys of scientific organizations. I also extend thanks to Zhenya Tsoy, the ISC's Senior Communications Officer and Digital Lead who had the foresight to open the conversation with Nick Scott, who together led this discussion.

This document was created to serve as a source of inspiration and guidance for ISC Members and other scientific organizations as they continue to evolve and thrive in the digital era.

Alison Meston
Director of Communications
International Science Council

Digital: A technological and cultural impact on organizations

To respond to the critical existential threats that humanity is facing, scientific organizations must be robust and agile to ensure that science is strong and relevant. But the nature, scope and breadth of what an organization is and does changes as technology and culture change. This is particularly true in the digital era.

So – what does 'digital' mean? When this question was put to staff and Members at an ISC workshop in late 2022, opinion was split between two definitions:

» **Digital is about being accessible online.** It means using online tools to connect, communicate, engage, share information and collaborate.
» **Digital is how we live in the 21st century.** It is all-encompassing. It is not related to being online but encompasses lives and the connection between people and/or machines.

It is not unusual to find that there is no common understanding of the word 'digital'; the meaning has changed over time and its use depends on context and each individual's experience and views. For example, 'digital transformation' is a subject of intense focus in the business world but it can be used to describe everything from small changes – like creating new products and services – to the wholesale restructuring of company operations, cultures and products to take advantage of digital technologies.

This document, developed for the ISC Membership and its Affiliated Bodies, will broadly use the latter definition: assuming that 'digital is how we live in the 21st century'. It will look at how many aspects of what ISC Members do – and how they do it – are changing in the digital era, and the opportunities and challenges those changes create.

The goal of this report is to offer inspiration and guidance for ISC Members and other science organizations as they move forward in their own digital transformation journeys, however they choose to define the word 'digital'.

A note on the Member survey and interviews

This document incorporates the findings of an online survey of ISC Members. The survey was undertaken in early 2023 and included 44 responses from national academies, unions, affiliated members and bodies with secretariats around the world (47 percent in Europe). The respondents ranged in size from small volunteer-only organizations (4 responses) and those with less than 25 members (18 responses) to larger organizations with more than 200 members (15 responses).

Respondents were mainly either executives (17 responses) or in communications or other support roles (12 responses). Survey completion was opt-in.

The survey was designed not as a scientific exercise, but to offer an initial barometer of what ISC Members are doing on digital and how they feel about their organizational capacity when it comes to incorporating digital into their organizational strategy.

The ISC aimed to identify Members who offered interesting results or made insightful comments that could then be interviewed for more information and for presentation at the ISC Mid-Term Members' Meeting in May 2023. Representatives from nine member organizations were interviewed and this report includes an overview of their cases.

Opportunities for science organizations in the digital age

Most ISC Members who responded to the survey felt they were 'advancing' in digital (figure 1). These Members see digital as part of their strategy but have not embedded it into everything they do. Though they are actively investing in technology and developing their skills, they feel they still have a way to go on their digital journey.

WHAT STAGE IS YOUR ORGANIZATION AT WITH DIGITAL?

Curious
5%

Advanced
23%

Starting out
20%

Advancing
52%
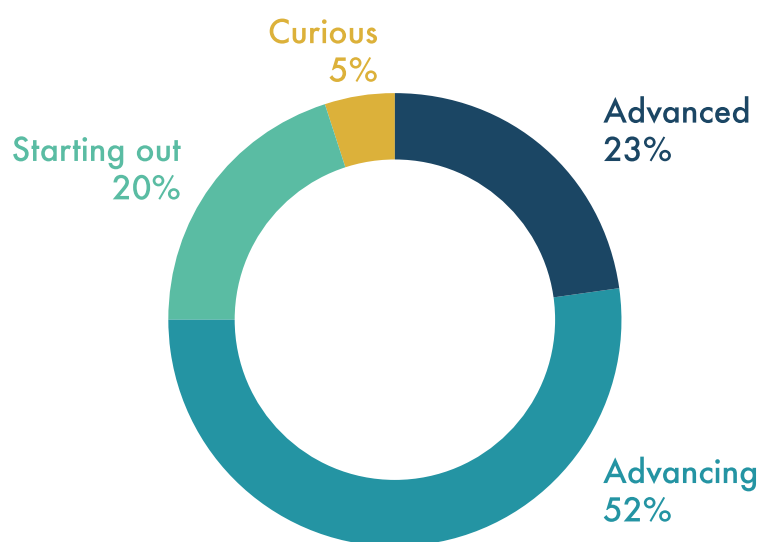
FIGURE 1: Level of advancement with digital transformations

There are three broad areas of opportunity for science organizations:
1. Creating more and deeper digital connections with members, other stakeholders or audiences.
2. Creating value in new ways, and doing so faster.
3. Changing skills, organizational structures and operational models to achieve new or different objectives.

This report will look at each in turn, outlining the context and relevance of each area for ISC Members, reviewing relevant findings from the survey and presenting case studies of ISC Members who have been working to realize these opportunities.

Area 1: Create more and deeper digital connections

The digital age has always had the potential to revolutionize how organizations – including ISC Members – connect with people: their members, audiences, stakeholders, staff and beyond.

In the physical world, there is always a trade-off between reach and richness: reaching more people compromises the richness, intensity and depth of their experiences. [1] A good example is a traditional in-person science conference, where reach is limited, but experiences are deep and rich (i.e. sophisticated and high-quality).

In the digital world, however, this dynamic changes. **Organizational reach can be expanded without sacrificing the quality of content and experience.** In fact, the ability to create unique and rich experiences can serve to give organizations greater reach.[2] Internet search engines reward richer and more unique content, serving it to more people and increasing its reach.[3] In the United Kingdom, the Royal Society, has created a whole programme to take advantage of this, creating rich content specifically designed to attract new audiences by targeting heavily searched Google keywords (case study 1).

The extra reach of rich content does not end with the potential for it to rank higher in search engine results; when scientists and other stakeholders see content that appeals to their interests, they can share it with their online networks, via LinkedIn, Academia.edu or ResearchGate, for example. These academic networking sites and commercial scholarly publishers expand their connections through extensive digital databases, providing scientists with both reach and richness of content.

1   Evans, P. and Wurster, T. S. (2000). 'Blown to bits: How the new economics of information transforms strategy', *Harvard Business Press*, 1 January. Available at: https://www.bcg.com/publications/2000/strategy-technology-digital-blown-to-bits

2   Evans, P. and Wurster, T. S. (2000). 'Blown to bits: How the new economics of information transforms strategy', *Harvard Business Press*, 1 January. Available at: https://www.bcg.com/publications/2000/strategy-technology-digital-blown-to-bits

3   Google (n.d.) *Search Engine Optimization (SEO) Starter Guide – Google Help*. Available at: https://support.google.com/webmasters/answer/7451184?hl=en/

*'We will reach a broader audience and impact public policy
by creating content specifically designed for Google'.*

The Royal Society is a large and complex institution. Its outputs span journals, scientific grants, policy work, industry programmes, school resources and public engagement events.

The challenge
With such a broad spectrum of outputs, the Royal Society's website must serve varied audiences efficiently. Enabling visitors to find relevant information quickly is paramount, yet ensuring this content is visible on search engines is a challenge.

The website transformation project
The Royal Society's website transformation project refreshed the site design and improved the backend tagging of content. This enables more efficient surfacing of richer information in different areas and allows search engines to better recommend content based on user behaviour and preferences.

The strategies
» **Stakeholder engagement:** The Royal Society conducted internal and external stakeholder interviews to refine the website navigation. The resulting insights helped clarify areas of contention, ultimately leading to the new web design.
» **Analytics-driven decisions:** The Royal Society used analytics tools to assess visitor flow and how users engaged with different sections of the website, supporting the development of an efficient, user-friendly design.
» **SEO and public engagement:** Before the current transformation project began, the Royal Society recognized that 60 percent of its web traffic came from Google organic search. This emphasized the importance of SEO – the process of adapting content and site structure to improve page rankings in search engines such as Google. To enhance SEO, the Royal Society now uses a question and answer format on policy report pages and for core information on important topics such as climate change and biodiversity loss. The questions on these pages mimic the types of queries that people typically type into search engines. By directly answering these questions and incorporating keyword research, the content genuinely caters to user needs as well as increasing its reach – with Royal Society content being selected as Google's 'featured snippet' at the top of search engine results pages for some topics.

The impact
Website analytics demonstrate that the work undertaken so far on the site has increased traffic and supported public perception of the Royal Society, particularly by creating content designed specifically for Google. When the fully updated website is launched in 2024, it is hoped that this will further expand the reach. Although measuring tangible impact is

challenging, informing the public and sharing scientific knowledge via the website is an important goal.

The practical concerns around Internet access and availability are no longer as central, as it can be assumed that most people will have Internet access at a reasonable speed, wherever they are and whenever they turn on their device. The onset of the COVID-19 pandemic accelerated this, as video calling became a staple for both personal interactions and professional collaboration.[4] With AI, even language barriers can be overcome, and people speaking different languages can connect and chat in a relatively seamless way.[5]

Rather than speed or accessibility, **context and inclusion are now the defining considerations for science organizations wishing to connect with people digitally.**

What someone browsing on their phone while watching TV might want to do is very different to a scientist or a policy-maker using their iPad at a science conference. The device and the channels they are using are also relevant – as are those that they are not.[6]

Inclusion is essential: as organizations connect with an ever more diverse range of people, they need to consider their audiences' backgrounds, cultures, languages, digital skills levels and more.[7] For science organizations, inclusion also means thinking about the lives and behaviours of the scientists they want to reach, and designing digital experiences and products in a way that works for them. The Global Young Academy's approach is a great example: they go to great lengths to understand the experiences of their members and build in features that respect their time, habits and lives – including thinking hard about how to keep time investment as low as possible (case study 2).

Case study 2: The Global Young Academy's member-centric approach

'We focus on what we can do for members rather than just what we need from them'.

The Global Young Academy gives a voice to young scientists and researchers around the world, fostering connections and aiding their professional growth.

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4   Colleen McClain, Emily A. Vogels, Andrew Perrin, Stella Sechopoulos and Lee Rainie. (2021). 'The Internet and the Pandemic', *Pew Research Center*, (1 September). Available at: https://www.pewresearch.org/internet/2021/09/01/the-internet-and-the-pandemic/

5   Jiao, W., Wang, W., Huang, J., Wang, X. and Tu, Z. (2023). 'Is ChatGPT a good translator? Yes with GPT-4 as the engine', *arXiv preprint*, arXiv:2301.08745. doi: https://arxiv.org/abs/2301.08745

6   Boag, P. (2016). 'Designing with the user's context in mind', Shopify blog, 17 March.
Available at: https://www.shopify.com/partners/blog/97802374-designing-with-the-users-context-in-mind

7   Westwater, H. (2021). 'Digital inclusion: What is it and why is it important?' *The Big* Issue, (6 December). Available at: https://www.bigissue.com/news/social-justice/digital-inclusion-what-is-it-and-why-is-it-important

The challenge

Young scientists have distinct needs, habits and communication preferences, and catering to a demographic that spans various age groups within the 'young' category presents a unique challenge. The Global Young Academy needed to design products and services that addressed these distinct needs and integrated them seamlessly into the busy lifestyles of early career professionals.

Engagement strategies

» **Nurturing member-to-member communication:** To foster a sense of community, especially among new members, the organization introduced initiatives such as connecting members to 'buddies' for the Annual General Meeting and linking them with mentors from a pool of experts. This has aided professional development and resulted in meaningful, long-term connections.

» **Focusing on members' needs and value:** The academy continuously optimizes its digital processes to ensure they respect the time constraints of its members. By streamlining communication and being responsive to members' needs, the academy ensures that members feel their involvement is worthwhile.

» **Understanding habits and preferences:** Recognizing that some members might lean towards modern communication channels, while others value traditional methods, the academy has sought to strike a balance. Regular reviews of member interactions provide insights into evolving preferences.

The impact

By tailoring its approach to cater to the specific needs and habits of young scientists, the Global Young Academy has created a robust, engaged community. This member-centric approach helps the academy resonate more deeply with its target demographic, ensuring members' continued, active involvement in the network.

Ultimately, poor, impersonal, irrelevant, or inauthentic experiences only serve to reduce the reach of science organizations. They must therefore develop a much deeper understanding of key audiences: their context, limitations and how to meet their specific needs. Fortunately, the digital realm provides organizations with an abundance of data, and leveraging this can lead to insights about user behaviour, preferences and pain points.[8] Science organizations can harness this data to fine-tune their offerings and better meet their audiences' needs.

The International Union of Pure and Applied Chemistry (IUPAC) is an example of an organization leveraging data to improve its offering: it runs surveys to understand member needs and preferences, and determines how to connect with them based on these insights (case study 3). Customizing their approach to connecting with different audience's needs and preferences, and creating unique content for specific audience segments – such as IUPAC's Global Women's Breakfast – are central to how communication works in the digital world.

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8   Brown, B., Kanagasabai, K., Pant, P. and Serpa Pinto, G. (2017). 'Capturing value from your customer data', *McKinsey & Company*, 15 March. Available at:
https://www.mckinsey.com/capabilities/quantumblack/our-insights/capturing-value-from-your-customer-data

Finally, it should be noted that connections facilitated by digital are not limited to people. Today, we are connected to objects embedded with AI, like our mobile phones, watches, fridges, speakers or microscopes.[9] Though robots and objects behave differently to people, context, inclusion and participation remain important. In future, the Royal Society will need to think hard about whether and how to organize its website to serve content to tools like ChatGPT and other large language models.[10] Similarly, IUPAC may need to consider which of its members use AI agents or voice assistants to connect with it, and how best to engage those intermediaries. Digital connection is about to get even more complicated.[11]

Case study 3: International Union of Pure and Applied Chemistry

'Our hope is to find ways to engage with our members in such a way that they will engage back more'.

IUPAC is a global organization with a diverse membership base. With its members varying in size and operational capacity, from large, professionally managed entities to smaller ones run by individuals, communicating and engaging with everyone effectively is challenging.

The challenge: Diverse digital engagement preferences
IUPAC's diverse member organizations have varied communication preferences. While some are inclined towards conventional channels like emails, others prefer more modern digital platforms. This poses a significant challenge for IUPAC: how best use its limited resources to communicate with audiences with many different preferences.

The digital engagement survey
To better understand its members' preferences and to refine its engagement strategy, IUPAC carried out a communication survey. The objective was to assess the effectiveness of its current communication channels and identify areas for improvement. The survey results guided IUPAC in optimizing its communication strategy, particularly in the domain of social media, to ensure that members are effectively engaged and receive relevant information through their preferred channels.

IUPAC also started creating digital events to connect to specific segments of its network. The Global Women's Breakfast started out as an event for women, and has grown into an event for anyone interested in making new connections in the global chemistry community. It has allowed IUPAC to showcase its work, connect directly with this community and reach a wider audience.

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9 Ghosh, I. (2020). 'AIoT: When artificial intelligence meets the Internet of Things', *Visual Capitalist*, 12 August. Available at: https://www.visualcapitalist.com/aiot-when-ai-meets-iot-technology/

10 International Science Council (2023). 'A framework for evaluating rapidly developing digital and related technologies: AI, Large Language Models and beyond'. *International Science Council*. Available at: https://council.science/publications/framework-digital-technologies/

11 Westcott, K., Arbanas, J., Arkenberg, C., Auxler, B., Loucks, J. and Downs, K. (2023). '2023 Digital media trends: Immersed and connected', *Deloitte Insights*, 14 April. Available at: https://www2.deloitte.com/uk/en/insights/industry/technology/media-industry-trends-2023.html

Future prospects

Using the insights from the communication survey, IUPAC aims to enhance its digital engagement strategy. By tailoring its communication methods to audience preferences, IUPAC hopes to foster stronger connections with its diverse member base and ensure that its messages resonate.

ISC Members' survey insights

Although many scientific organizations start their digital transformation journeys through digital communications and engagement, the ISC Members' survey revealed that this was the area where they felt their skills were weakest (figure 2). Across all organizations, the strongest reported skill in this area was social media (2.6 out of 4); the weakest were SEO (1.7/4) and digital fundraising (1.3/4). This underscores the challenge of enhancing digital strategies for reaching and engaging with audiences in rich and relevant ways.
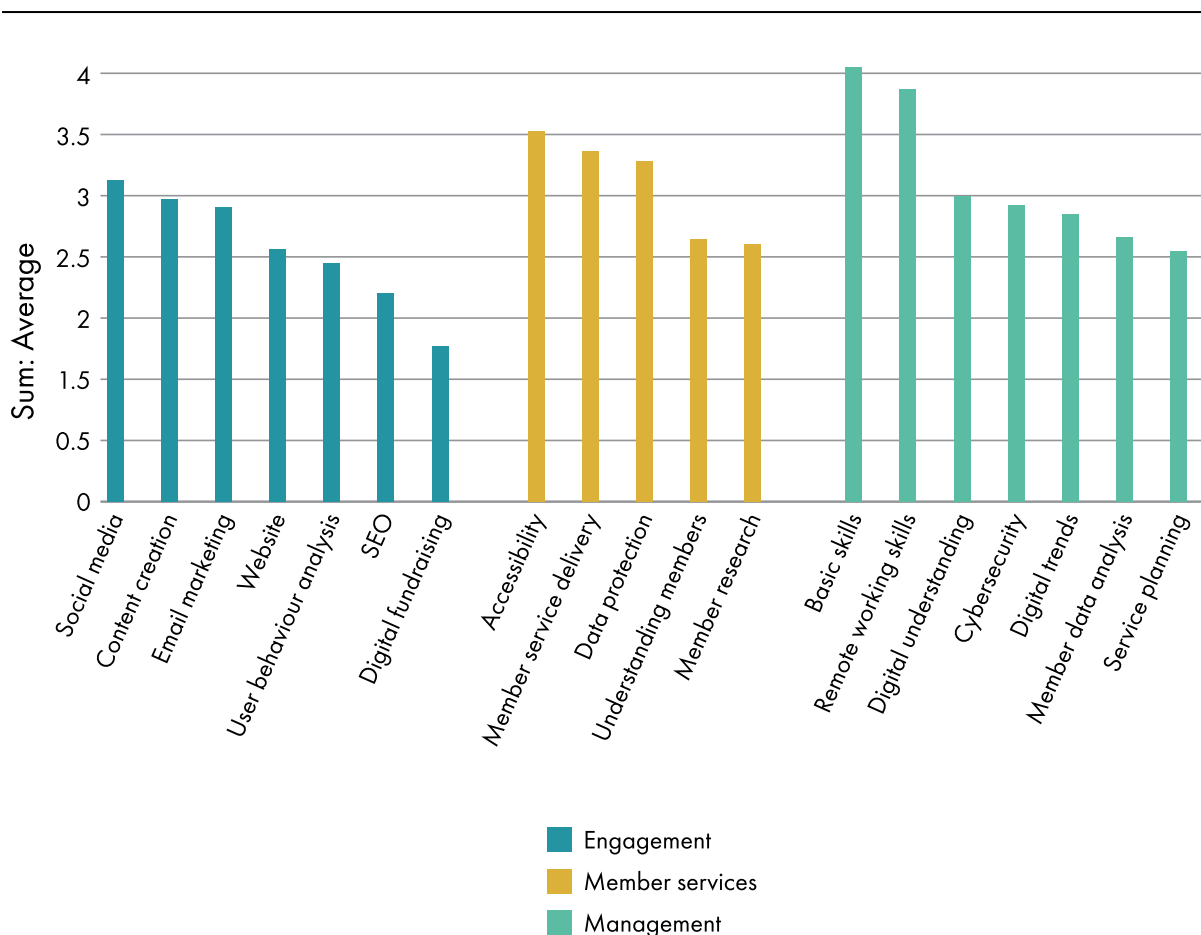

FIGURE 2. ISC Member digital skills

Engagement does, however, seem to be a priority in digital for all Members. Even organizations that reported medium or low skill levels in digital engagement prioritized the dissemination of scientific knowledge, indicating that outreach and engagement are fundamental objectives irrespective of their level of proficiency.

In terms of the key barriers to developing engagement skills, the survey showed that Members reporting lower skills levels identified basic needs like 'A clear vision of what we could achieve with digital', 'Ability to adapt quickly to change' and 'Understanding of digital tools'. As skills levels increased, Members emphasized more complex needs: 'Understanding of digital trends and how they affect your organization', 'Ability to develop and embed a good digital strategy' and 'Digital leadership skills (e.g., being more collaborative)'.

Key questions for reflection

1. **Digital strategy alignment**
   » How does your organization's current digital strategy align with the changing dynamics of reach and richness in the digital age?
   » In what ways are you leveraging the power of rich content to enhance your reach?

2. **Inclusion and context**
   » How does your organization ensure digital inclusivity, taking into account diverse backgrounds, cultures, languages and digital skill levels?
   » Are you tailoring your digital content and engagement strategies based on the context in which your audience interacts with it?

3. **Continuous learning and feedback**
   » How frequently does your organization gather feedback on its digital strategies and engagement efforts?
   » What mechanisms are in place to adapt and evolve based on this feedback?

4. **Member-centric approach**
   » In what ways is your organization prioritizing the needs and preferences of its members in its digital initiatives?
   » How are you ensuring that member engagement is both meaningful and valuable for the members themselves?

5. **Future-proofing**
   » How is your organization preparing for the increasing integration of AI and digital tools in member engagement and communication?
   » What steps are you taking to ensure your digital strategy remains relevant as technology continues to evolve?

Area 2: Create value through new products and services, quickly

As digital transformation is reshaping every aspect of our lives, science organizations stand at the crossroads of tradition and innovation. The digital revolution offers unprecedented opportunities to innovate, expand reach and create value in ways previously unimagined – and to do so with unprecedented speed.[12]

The most obvious place this is happening is in the value of information products: audiences can find new value in products through digital channels. Conversely, an overload of information makes it harder than ever for specific products and information to stand out, leading to the digital age being described as having an 'attention economy'.[13]

The '**long tail**' is a term that captures a real opportunity for science organizations, and one that they probably understand quite well. The term refers to the dynamic between cost and abundance. Some mainstream products are bought, accessed or used in huge numbers, as was ever the case. But in the digital world, a vast number of niche and limited interests can now be accessed just as cheaply and easily. This phenomenon feeds platforms like Amazon, which thrive on offering a plethora of products, from bestsellers to niche items.[14]

Long tail also means that science organizations working in relatively niche areas and with relatively niche products can make those available, knowing that even though the market for those products is small, it exists. This is therefore not just about which products or services people choose, it is also about which products or services can be marketed and to whom.

The World Anthropological Union (WAU) is an example of an organization that has done just that: its business model has been transformed by targeting niches with content that is of specific value to them (case study 4). Being a 'member' is not the selling point, and membership does not come with an annual fee. Instead, people now become members when they pay to participate in an activity (an event, seminar or similar). Even though the WAU is targeting smaller audience segments – with many different propositions rather than a single membership proposition – it is growing its membership. This is a membership strategy focused on the long tail.

12 Hill, L.A., Le Cam, A., Menon, S., and Tedards, E. (2022). 'Leading in the digital era: Where can digital transformation take you?' *Harvard Business School Working Knowledge.*
    Available at: https://hbswk.hbs.edu/item/leading-in-the-digital-era-where-can-digital-transformation-take-you

13 Joy, A. (2021). 'The attention economy: Where the customer becomes the product', *Business Today Online Journal*, 18 February. Available at https://journal.businesstoday.org/bt-online/2021/the-attention-economy-asher-joy

14 Anderson, C. (2006). *The long tail: Why the future of business is selling less of more.* Hyperion.

'We decided to abandon our traditional membership model and now there's more contact with people from outside the organization'.

The WAU is an umbrella organization with a bicameral structure: the International Union of Anthropological and Ethnological Sciences for individual members, and the World Council of Anthropological Associations for organizations.

The challenge

The WAU's traditional membership model was based on an annual fee structure, providing members with exclusive access to content and events. However, geographical limitations and changing demographics in academia posed significant barriers. Many international members could not attend in-person events due to logistic issues or lack of documentation. The union's aim to be inclusive and adaptive faced significant hurdles.

Digital evolution

» **Rethinking membership models:** The WAU transitioned from its traditional membership model to a more open approach. Now, individuals become members upon participating in a WAU-organized activity, removing the need for separate membership drives.

» **Focus on inclusion:** A primary motivator for this digital shift was inclusion. The WAU wanted to cater to global members who could not attend on-site events due to various constraints, but could more easily participate in digitally-enabled or digitally-enhanced events and activities.

» **Diversifying communication**: The WAU's communication became more open and transparent. Instead of expecting members to reach out, they now actively try to reach members across multiple platforms.

Impact and learnings

The new approach saw the WAU becoming more diverse and international. More members have joined, and the organization has become more outward facing.

Science organizations can choose to cater to large or niche audiences, or both at the same time, using the same infrastructure – such as a website, a webinar platform or other service. This is possible because in many digital ecosystems, once the initial infrastructure (like a website or a software application) is set up, adding another user or producing another digital product unit comes at virtually no additional cost. This is known as '**zero marginal cost**'. Take OpenAI's ChatGPT, for instance. Once the infrastructure is in place for the first user, every subsequent user costs virtually nothing to add.[15]

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15 Dawson, A., Hirt, M., and Scanlan, J. (2016). 'The economic essentials of digital strategy', *McKinsey Quarterly*, 15 March. Available at: https://www.mckinsey.com/capabilities/strategy-and-corporate-finance/our-insights/the-economic-essentials-of-digital-strategy

The Organization for Women in Science for the Developing World (OWSD) has taken advantage of this to develop a series of services for members on its website – profiles that automatically populate, and simple templates for activities and news items – that are fully scalable (case study 5). The initial costs to build this system are high, but once built the number of users is not a major limitation. This kind of profile system would not have been feasible without zero marginal cost digital technology. The OWSD has used this to create value for members that deepens engagement and connection with the organization, without having to worry about limiting numbers.

Case study 5: The Organization for Women in Science for the Developing World

'We're building a digital gathering point for our members'.

The OWSD is dedicated to supporting and promoting women in science, particularly in low-income countries.

The challenge
OWSD needed to strengthen engagement with its extensive membership and effectively communicate the experiences and stories of women scientists in the Global South. This challenge was intensified during the COVID-19 pandemic, as traditional engagement methods were restricted.

Digital innovations
» **Membership profiles:** The OWSD created profiles for more than 9,000 members on its website. It is now developing an algorithm to update these profiles automatically with members' activities, publications and presentations.
» **Decentralized content creation:** The OWSD initiated a system allowing nominated members from national chapters to upload news items, maximizing the organization's capacity and ensuring a steady stream of fresh content.
» **Video storytelling:** In response to the pandemic, the OWSD pivoted to video. It hired a filmmaker to develop a curriculum and trained filmmakers in different countries. Using basic tools like mobile phones, the resulting videos were compelling and effective.

Impact and learnings
Through user-generated content and personalized member profiles, the OWSD has given members a stronger voice and a sense of protagonism. Capacity building in storytelling has emerged as a focus area, given its potential for impact – the shift to video content during the pandemic showcased the OWSD's ability to adapt to challenges and still deliver quality content.

This case study highlights another new route to value that digital offers science organizations: the possibility of **co-creating value** with their audiences. The OWSD's digital video training programme used social media and other digital technologies to offer value for its audiences (the training) and then get value back (receiving videos created for its website). In general, people today want to connect with organizations and peers as participants: sharing, co-creating and co-owning these connections, not just being passive recipients.[16]

Participation is essential in the final opportunity digital offers to science organizations seeking to create value: **network effects**. Network effects describes the phenomenon where the value of a service or platform increases as more people use it. For social media platforms such as Facebook or X (formerly Twitter); the more users they have, the more valuable they become to each user, as there are more connections to be made and content to be consumed. This principle underpins many digital platforms today: Uber, Airbnb and more would not work without it. Within the world of science, the open science movement and the rise of preprint sharing platforms are testament to how scientists have tapped into these network effects, bypassing traditional publishing routes. ISC Members are also networks; they should consider how they can support their own members in accessing network effects.

Value is also delivered through speed. Digital technology moves rapidly, therefore value creation must too. Agility in testing ideas and concepts quickly and early is essential. Many methodologies have been developed that specifically seek to enable agility and user-centred testing, including Agile, Design Thinking and Lean.[17] Science organizations can rapidly test new products or services, gather feedback, iterate, and then scale what works. This reduces the risk of large-scale failures and ensures that resources are invested in ideas that have been validated by the target audience. The WAU (case study 4) could, for example, test different event ideas more easily and see what interest they receive, only delivering those that are proven to get audiences. Similarly, the OWSD (case study 5) could choose to test a minimum viable product version of a new feature on its membership database. If the members respond to the new feature, the OWSD can develop it more fully; if there is no response, it does not.

ISC Members' survey insights

The ISC survey highlighted the many ways Members feel digital technologies could support their future plans. In particular, they saw them as important to delivering better services and disseminating knowledge in the digital age. Additionally, influencing policy-makers, boosting administrative efficiency and promoting open science were objectives for many organizations.

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16 Heimans, J. and Timms, H. (2014). 'Understanding "New Power"', *Harvard Business Review*, December. Available at: https://hbr.org/2014/12/understanding-new-power

17 Schneider, J. (2018). 'Understanding how Design Thinking, Lean and Agile Work Together', *Thoughtworks*, 28 January. Available at: https://www.thoughtworks.com/insights/blog/understanding-how-design-thinking-lean-and-agile-work-together
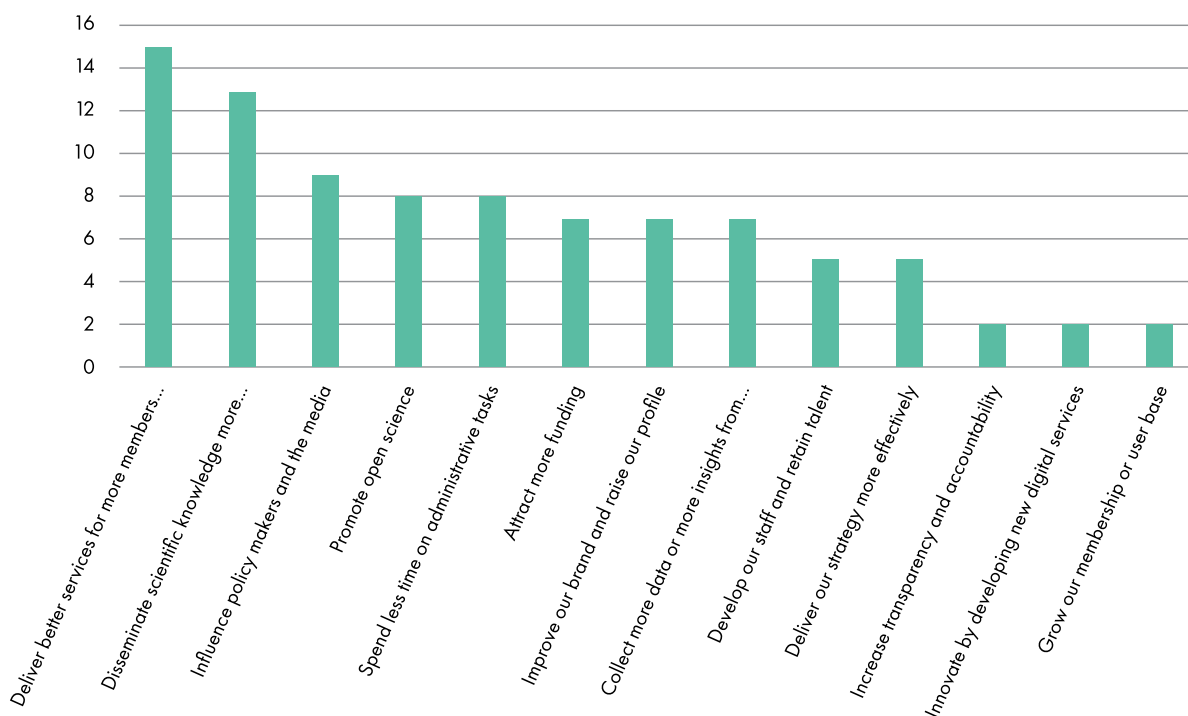
FIGURE 3. ISC Members' key digital objectives

Organizations reported different digital objectives, based on the overall confidence they had in their digital skills. For example, organizations reporting overall high or medium skill levels emphasized 'Promote open science' and 'Disseminate scientific knowledge more widely'. This might indicate they have the necessary digital tools and expertise to start using digital as a core part of impact-seeking.

Organizations with medium skill levels prioritized 'Deliver better services for more members/users', perhaps indicating they have attained a certain level of digital competency and are now focusing on leveraging those skills to enhance their service delivery.

Key questions for reflection

1. **Value creation and digital products**:
» How might your organization use digital platforms to introduce new products or services?
» In what ways are you optimizing the potential of the digital 'long tail' to offer both mainstream and niche products/services?

2. **Engagement and membership models:**
» How are you adapting your membership models to cater to the diverse needs of your members in the digital age?
» What strategies are in place to ensure both traditional and digitally forward-thinking members find value in their association with your organization?

3. **Infrastructure and scalability:**
» How are you ensuring that your digital infrastructure is scalable, allowing you to cater to growing audiences?

4. Co-creation and participation:

» How are you fostering a culture of co-creation and participation among your members, allowing them to contribute and derive value?

» In what ways are you leveraging network effects to enhance the value proposition of your platforms and services?

5. Rapid prototyping and feedback:

» How could your organization leverage rapid prototyping to test and validate new digital initiatives?

» How are you incorporating member feedback in real-time to iterate and improve upon your digital products and services?

6. Future challenges:

» What steps are you taking to navigate the challenges of information overload, technology adaptability and striking a balance between innovation and inclusion?

» How are you preparing your organization to integrate and leverage the advancements in AI – for speed or value for your audiences?

Area 3: Evolving team skills, new structures and operational models

In the face of rapid technological advancements, science organizations need to evolve in terms of their operational models, team skills and structures to remain relevant and effective. In other words, *how organizations do their work in the digital era* is core to *what they can achieve* through digital.

Working at speed

The digital world is characterized by its relentless pace, with developments often unfolding exponentially.[18] Exponential progress can double with each iteration, leading to swift and frequently unforeseen outcomes. This concept can be difficult for people and organizations to grasp, as witnessed during the early stages of the COVID-19 pandemic, when many found it challenging to fathom how a few isolated cases could quickly burgeon into a worldwide emergency.[19]

A current example of this rapid growth is the rise of generative AI tools, such as ChatGPT. These tools, which can produce new, original content, were barely known a year ago but have seen swift integration into business strategies. Less than five months after ChatGPT's release in November 2022, nearly one quarter of C-suite executives surveyed by McKinsey had incorporated generative AI technology into their work, and 28 percent of boards had plans to discuss how to incorporate it into operational plans, a testament to its transformative potential.[20]

Harnessing digital tools for agility

This rapid evolution underscores the need for agility. As the digital landscape evolves, so too does the toolkit available to science organizations. Digital tools can facilitate seamless information sharing and foster networking across diverse locations and teams. They allow collaborative work to be asynchronous, so individuals can contribute at their own pace. This shift can enable more decentralized organizational structures, with increased autonomy for staff and greater opportunities for interdisciplinary collaboration.[21] The potential benefits for science organizations are manifold: heightened agility, innovative discoveries and robust ways of operation.

The Nigerian Academy of Science provides a compelling illustration of this digital transformation (case study 6). By digitizing its organizational processes, the academy has both accelerated decision-making and increased member participation in this process.

18 Azhar, A. (2021). *Exponential: How accelerating technology is leaving us behind and what to do about it.* Random House Business.

19 Lammers, J., Crusius, J. and Gast, A. (2020). 'Correcting misperceptions of exponential coronavirus growth increases support for social distancing'. *Proceedings of the National Academy of Sciences*, 117(28), pp. 16264–16266. https://www.pnas.org/doi/pdf/10.1073/pnas.2006048117

20 McKinsey & Company. (2023). 'The state of AI in 2023: Generative AI's breakout year', 1 August. Available at: https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-state-of-ai-in-2023-generative-ais-breakout-year

21 De la Boutetière, H., Montagner, A. and Reich, A. (2018). 'Unlocking success in digital transformations', *McKinsey & Company*, 29 October. Available at: https://www.mckinsey.com/capabilities/people-and-organizational-performance/our-insights/unlocking-success-in-digital-transformations

'Our aim is to be as digital as possible'.

The Nigerian Academy of Science, established in 1977, is Nigeria's foremost scientific institution. Its primary duty is to provide governmental bodies with evidence-based advice, leveraging science, technology and innovation to address national issues.

The challenge

The COVID-19 pandemic underscored the necessity for adaptability and resilience. Traditional modes of operation, including in-person meetings, were often impossible. The Nigerian Academy of Science faced the dual challenge of maintaining effective communication among its extensive fellowship and continuing its advisory role without interruption.

Digital innovations

» **Virtual communications:** Meetings, public lectures and other crucial communications shifted to digital platforms, ensuring uninterrupted operations.
» **Digital voting and grants:** The academy strengthened its digital voting mechanisms for the election of fellows and streamlined grant applications via online platforms.
» **Financial management:** Financial approvals and management were transitioned to a digital environment.

Impact and learnings

The academy's rapid digital transformation, while a response to the pandemic, revealed the potential benefits of a more digitized operational model. Participation in the council meetings was preserved, and perhaps even enhanced, as feedback and interactions flourished on platforms like Zoom, WhatsApp and email.

Looking ahead

While issues such as network instability and unreliable electricity supply remain a challenge, the academy stays committed to its digital strategy. It envisions a future where digital tools enable everything, from advisory to education. It has ambitious plans, such as the establishment of e-libraries and the creation of a science museum, to further digital engagement and education.

Changing processes is not the only area of opportunity and challenge: **new skills** are needed, too. Staff in science organizations wishing to increase their adaptability and take advantage of digital opportunities need to acquire new digital skills to be fluent in how digital works, the use and development of software, and understanding digital systems and data.[22]

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22 Dondi, M., Klier, J., Panier, F. and Schubert, J. (2018). 'Defining the skills citizens will need in the future world of work', *McKinsey & Company*, 25 June. Available at: https://www.mckinsey.com/industries/public-sector/our-insights/defining-the-skills-citizens-will-need-in-the-future-world-of-work

The Scientific Committee on Oceanic Research (SCOR) offers a great example. The ability to create huge reams of data using digital sensors and tools meant the organization had to develop new skills in digital data management (case study 7).

Incorporating new skills in automation can offer science organizations great potential savings. Any repeatable action can be a target for automation, using connected systems and robots . This is not about replacing staff; humans are essential in guiding, supervising and augmenting automated processes. But through automation, science organizations can reduce staff time spent on administrative and low-value tasks, something that management processes are full of. Automation can also support more efficient research processes, data collection and hypothesis testing. But to take advantage of this, science organizations must incorporate new skills, skilling up humans to guide the robots.[23]

Case study 7: Scientific Committee on Oceanic Research

*'We need data to be more easily accessible
in a very efficient way'*

SCOR is an international non-governmental organization which promotes scientific investigations in the field of oceanic research.

The challenge

As the technical capabilities of oceanic research expand, so do the volume and complexity of data. The sheer magnitude of data being generated, coupled with the need for collaboration across global teams, pose significant challenges. SCOR recognized the need for efficient digital data management and enhanced communication tools to ensure continuous and effective scientific collaboration. A key focus for SCOR is facilitating effective and sustainable digital data platforms within projects.

Highlighted digital platforms

» **The International Quiet Ocean Experiment** is compiling a meta-database of ocean sound observations (more than 5,000 records). Additionally, a working group is seeking to develop a global library of underwater biological sounds that will improve accessibility and make use of emerging machine learning computing capabilities to identify sounds.

» **The GEOTRACES Project,** which collects data on trace elements and isotopes in the ocean, addresses the need to consolidate data and make it publicly accessible. Recognizing this, the GEOTRACES Data Assembly Centre (GDAC) prepares data for archiving for long-term use and issues Intermediate Data Products every three to four years. SCOR supported the sustainability of the GEOTRACES dataset through the hosting of the GDAC by the British Oceanographic Data Centre.

23 Bughin, J., Hazan, E., Lund, S., Dahlström, P., Subramaniam, A. and Wiesinger, A. (2018). 'Skill shift: Automation and the future of the workforce', *McKinsey Global Institute*, 23 May. Available at: https://www.mckinsey.com/ featured-insights/future-of-work/skill-shift-automation-and-the-future-of-the-workforce

Impact and Learnings

Digital platforms have not only made vast amounts of data accessible but have also fostered global collaboration. This bridges gaps and ensures that scientists worldwide have access to the same information.

Changes in processes and skills inevitably impact **organizational culture**.[24] There are many examples of how this happens: the rise of remote work has shifted expectations around work-life balance; the adoption of tools like email, Slack or Microsoft Teams change people's expectations around response times; and the speed of change in skills creates a need for training to support continuous improvement.

Every one of these changes is both a challenge and an opportunity. By embracing and supporting culture change, organizations can create new opportunities, becoming more inclusive, efficient, innovative and impactful. The key lies in recognizing the opportunities and strategically integrating them into the organizational fabric: hiring talent from around the world thanks to the implementation of remote work policies; fostering real-time collaboration processes to reduce back-and-forward sending of email attachments; and developing continuous improvement programmes that train staff and members.

Where organizations are not able to adapt quickly in the face of change, they face **strategic risks**. In the commercial world, the motivations for undertaking digital transformation of processes, skills, cultures and business models are often framed around risks. This is based on hard experience: established companies such as Kodak and Blockbuster were consigned to history because they did not respond to digital changes – like the digital camera and video-on-demand – effectively. Likewise, traditional media outlets that did not quickly adapt to online journalism faced dwindling readership as audiences migrated to digital news platforms.[25] The winner-takes-all nature of many digital products, as seen with platforms like Google and Facebook, adds to the risk for those companies that see competition from new platforms.[26]

Though the examples above relate to for-profit companies, science organizations are not completely immune from strategic risk. There are new 'decentralized autonomous organizations' (DAOs) experimenting with different forms of connection and organization around science.[27] Examples include VitaDAO, Lab DAO and the DeSci Foundation. These are membership organizations, where collaboration is built around 'smart contracts' and other innovations that use emerging digital technologies such as the blockchain. They represent a different way of delivering the same sense of connection, collaboration and belonging – but adapted to a generation of scientists and researchers who are digital natives.

24 Buchanan, J., Kelley, B. and Hatch, A. (2016). 'Digital workplace and culture: How digital technologies are changing the workforce and how enterprises can adapt and evolve', *Deloitte*. Available at: https://www2.deloitte.com/content/dam/Deloitte/us/Documents/human-capital/us-cons-digital-workplace-and-culture.pdf

25 Solis, B. (2014). 'Digital Darwinism: How disruptive technology is changing business for good', *Wired*, 24 April. Available at: https://www.wired.com/insights/2014/04/digital-darwinism-disruptive-technology-changing-business-good/

26 Barwise, P. and Watkins, L. (2018). 'Nine reasons why tech markets are winner-take-all', *London Business School Review*, 18 July. Available at: https://www.london.edu/think/nine-reasons-why-tech-markets-are-winner-take-all

27 Hamburg, S. (2021). 'Call to join the decentralized science movement', *Nature*, 600, p. 221. doi: 10.1038/d41586-021-03642-9

Whether these (or other digital organizations) become a threat to the science organizations of today will depend on whether those older organizations can adapt and incorporate digital processes that meet the needs of scientists raised in the digital age. Organizations that do not adapt to digital shifts might struggle to attract or retain younger scientists who expect modern tools and platforms. But we can all learn from – or even collaborate with – these new forms of digital-first organizations, turning potential threats into golden opportunities.

Survey insights on ISC Members

The Member survey asked respondents to categorize their skills levels across three areas (engagement, member services and management). It is interesting to note that organizations often showed consistency in their skill levels across categories, especially at the extremes (either low or high in all areas). This indicates that skills, in general, are developed not in one area but across the organization.

However, there were some nuances, with some organizations excelling in one or two areas while lagging in another; for example, organizations with low skill levels in engagement and medium-level skills in management that have medium or high skill levels in member services (three and five organizations respectively).

The survey also looked at the key challenges ISC Members face regarding digital inclusion, skills and data.

What are the biggest challenges your organization faces in relation to digital?	
Fostering digital literacy among staff and members/users	23%
A need to upskill or hire staff	23%
Collecting, managing and using data	20%
Ensuring all members/users can access digital services	18%
Ensuring digital security and privacy	18%
Finding funds to invest in the devices, software or infrastructure needed	18%
Finding time to plan/focus on digital	16%
Maintaining public trust in science	14%
Some aspects of our organization are more digitally mature than others	14%
Balancing scientific rigour with digital speed and agility	11%
Staff burnout and workload from intense remote working demands (e.g., Zoom fatigue, information overload)	11%

Finally, looking to the future, ethics and processes for collecting member data emerged as a key concern for most ISC Members. This indicates again the importance of data skills and knowledge for organizations in this area.

IS YOU ORGANIZATION ACTIVELY CONCERNED ABOUT ANY OF THE FOLLOWING ISSUES SURROUNDING TECHNOLOGY AND DIGITAL CULTURE?
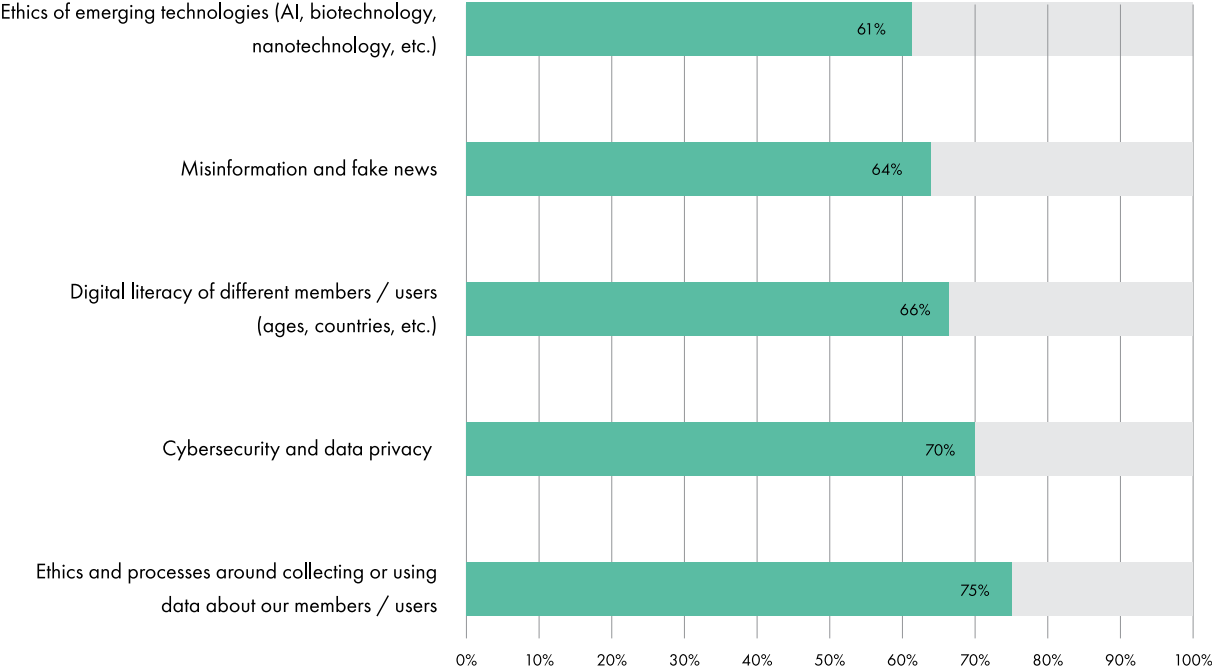
Concern	Percentage
Ethics of emerging technologies (AI, biotechnology, nanotechnology, etc.)	61%
Misinformation and fake news	64%
Digital literacy of different members / users (ages, countries, etc.)	66%
Cybersecurity and data privacy	70%
Ethics and processes around collecting or using data about our members / users	75%

FIGURE 4: ISC Members' concerns around technology and digital culture

A final finding sought to understand the priority for respondents to enable them to make progress in building their digital programmes. Overall they felt they needed to *better understand digital trends and possibilities*.

IN ORDER TO PROGRESS WITH DIGITAL, WHAT SKILLS, KNOWLEDGE OR BEHAVIOUR WOULD YOUR ORGANIZATION NEED TO IMPROVE IN THE NEXT 18 MONTHS?
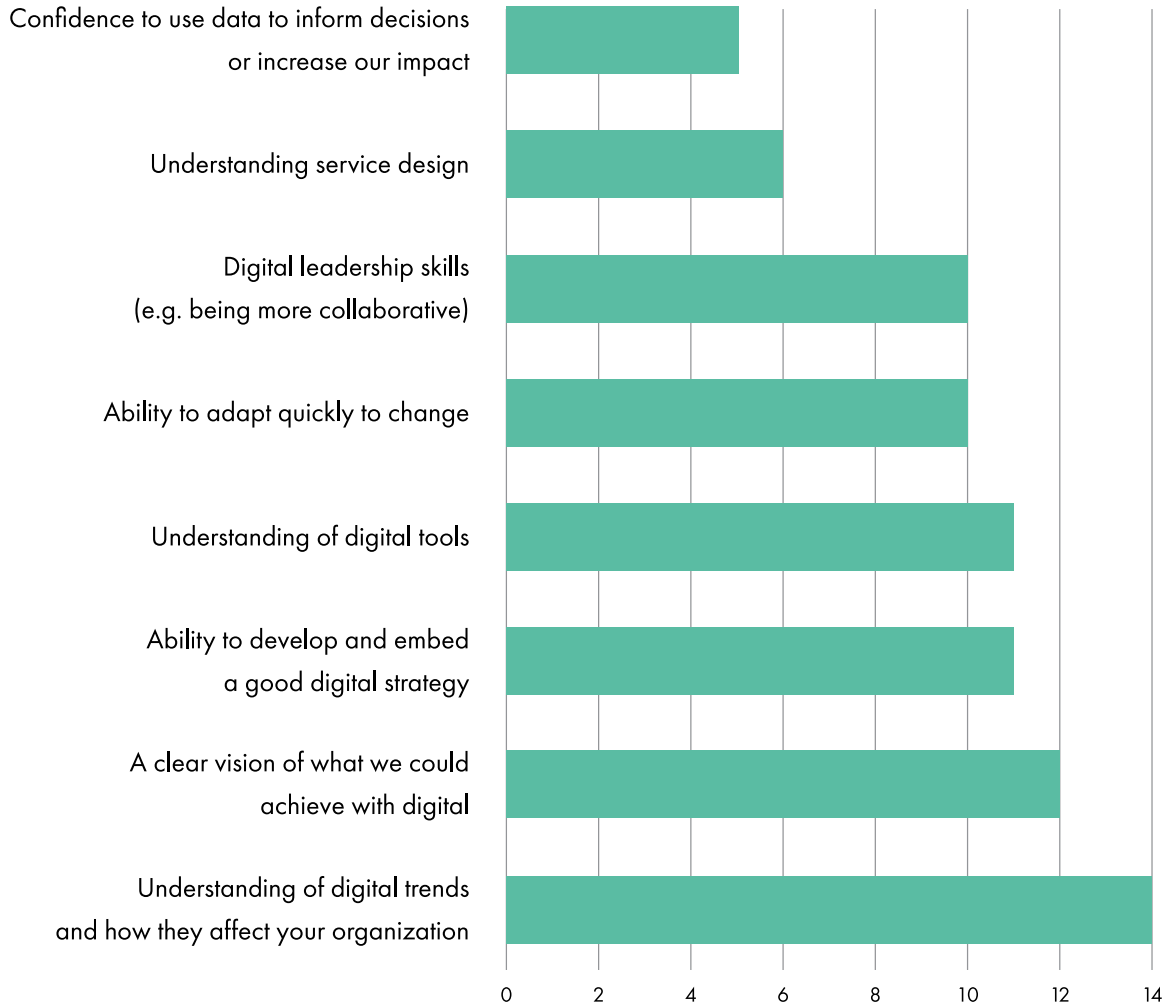

FIGURE 5: ISC Members' assessment of skills, knowledge and behaviour required for improvement

1. **Organizational structure**
   » How is your organization reshaping its structure and operations to be more adaptive in the digital era?
   » What steps are you taking to transition from traditional to more agile organizational structures?
   » Do you employ people with digital skills and knowledge in senior roles – on boards or leadership teams?

2. **Team skills**
   » What initiatives are in place to upskill your team members, ensuring they are equipped to harness the potential of digital tools?
   » How are you promoting a culture of continuous learning and adaptation in the face of rapidly changing digital tools?

3. **Embracing automation**
   » In what areas of your organization's operations are you exploring automation to boost efficiency?
   » How are you ensuring that the human touch remains central even as automation takes on a larger role?

4. **Data management**
   » What strategies have you employed to manage the growing volumes of data generated by digital tools?
   » How are you ensuring data sustainability and accessibility, especially for long-term projects?

5. **Organizational culture**
   » How are you nurturing a culture that is receptive to digital change and sees it as an opportunity rather than a threat?
   » What mechanisms are in place to gather feedback on cultural shifts and ensure that they align with your organization's core values?

6. **Risk management**
   » How are you identifying and addressing the potential risks associated with digital transformation?
   » In what ways are you preparing your organization to remain agile and adaptive in an ever-evolving digital landscape?

7. **Collaboration and interdisciplinary integration**
   » How are you leveraging digital tools to foster interdisciplinary collaboration and innovation?
   » What platforms or strategies have you found most effective in enhancing collaboration and cohesion within the scientific community?

8. **The digital native generation**
   » How is your organization adapting its strategies to cater to the needs of scientists and researchers who are digital natives?
   » What steps are you taking to ensure that your digital processes resonate with younger members and attract them to your organization?

Conclusion

The digital age brings immense opportunities for science organizations to enhance their operations, expand their reach and increase their impact.

However, as this report demonstrates, there is no one-size-fits-all approach to digital transformation. Organizations are starting from different points and focusing transformation efforts on different areas based on their unique contexts. For example, the Royal Society has used its position and knowledge to find opportunities to use SEO to reach wider audiences (case study 1), while the Global Young Academy has focused on how it can best engage members who have particular needs (case study 2). The WAU has seen an opportunity to overhaul its model to reach a more global membership (case study 4).

Broadly, there are three areas of opportunity identified in this report:

First, digital connections allow organizations to transcend barriers and foster meaningful interactions with diverse stakeholders. However, digital communications are a key skills gap for many Members, so capacity building and focus are required.

Second, digital platforms and tools can help create and deliver value through new products, services and experiences, often at speed and scale. The hub that the OWSD is building for its members (case study 5) is a great example of this, but doing so requires investment and commitment to develop with users in mind.

Third, adapting team skills, organizational structures and processes is crucial to remain agile. The pandemic forced this upon the Nigerian Academy of Science (case study 6), and it has benefited as a result. But changing teams, structures and processes is never simple, and requires deep understanding of why change is being sought and what success will look like.

While digital promises many opportunities for science organizations, the digital shift also surfaces challenges around change management, skills gaps, cultural evolution and balancing tradition with innovation. A nuanced approach is essential. Organizations must chart their own unique digital journey aligned to their purpose and values. Collaboration and sharing of experiences, as facilitated by networks like the ISC, are invaluable.

Digital transformation is not a one-time initiative, but an ongoing process of experimentation, feedback and learning. Digital transformation is as much about people and culture as it is about tools. By embracing it thoughtfully, science organizations can achieve greater sustainability, inclusion and impact. Though risks exist, the scale of opportunities afforded by digital far outweighs them – particularly as developments in AI now promise to accelerate digital change in society.

For organizations that seek to keep pace with technology while staying grounded in their mission, and adopting a spirit of openness and learning, digital holds promise of bringing more engaged members, more impact and more relevance.

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