Open UP! How digitization is Changing Science: An Exhibition of ZBW – Leibniz Information Centre for Economics

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Abstract: The range of activities conducted by scientific libraries is becoming more complex and diverse. While librarians debate whether the generic term "library" adequately conveys the range of activities they conduct, researchers see "library" primarily through a lens of nostalgia. On the occasion of its 100th birthday, ZBW – Leibniz Information Centre for Economics (Germany) launched an interactive exhibition, "Open UP! How digitization changes science," to better convey the relevance of scientific libraries in society. This article highlights the development of the exhibition itself and analyzes visitors' response to it.

Keywords: Public relations, open science, exhibitions, science communication

Introduction

Digitization is a current buzzword in almost every walk of life. This also applies to education (how we learn) and science (how we conduct and publish research). Not only are the formats used to present scientific content changing, but the speed at which new content is generated is accelerating. Throughout this process, the central instances of a knowledge society—libraries—are also changing. Over the past century, the range of tasks and the service portfolio of scientific libraries have expanded considerably.

This qualitative development is logical and comprehensible for both libraries and modern science policy. The public, on the other hand, is socialized with the idea of a library as primarily an analog place characterized by print material rather than as a provider of digital content. This socialization is reinforced by media reports in which the library is presented as a "third place," as a meeting place for different social groups, as a place for the storage of unique cultural assets, or as a

place of learning. In most instances, the library is presented as an accessible place, rarely as a provider of digital services where buildings and rooms are negligible.

In recent years, this gap has led to scientific infrastructure service providers often having to explain their current profile at great expense. From the point of view of ZBW – Leibniz Information Centre for Economics, however, it is particularly important that various stakeholders, such as users or partners in cooperative research projects, fully understand how and why ZBW is transforming itself and how the digital world is opening up new fields of activity and new service offerings.

In order to bridge this gap, continually engaging with all stakeholder groups is necessary. It is important to present complex facts from science and information infrastructure in an interesting and understandable way. Fixed images of what an infrastructure organization (in other words, a research library) does and can do must be disabused and supposed certainties readjusted so that the social relevance of research results and infrastructure projects can be grasped in the truest sense of the word. The following section will explain how this process of making research results and infrastructure projects comprehensible can be organized through an interactive exhibition.

Background

On February 1, 2019, ZBW celebrated its 100th birthday, and it now looks back on one hundred years of library history. Visitors to the ZBW website (https://100years.zbw.eu) can find out about the institution's history (https://100years.zbw.eu/history), including a staff podcast (German only, https://100jahre.zbw.eu/podcast); birthday wishes sent by cooperation partners (https://100years.zbw.eu/birthday-wishes); and events associated with the 100th anniversary (https://100years.zbw.eu/current-events). A subpage is dedicated to the exhibition, the central component of all events marking the information center's 100th birthday (https://100years.zbw.eu/openup).

Founded in 1919 as a department of the Kiel Institute, ZBW was a small institute library with eight employees. Today, it is an independent foundation under public law and a member of the Leibniz Association, with about 300 employees, a research department for computer science and information science, plus cooperation partners from all over the world, including university-based institutes and libraries located in Denmark (Aarhus University Library), Japan (Institute of Economic Research, Hitotsubashi University), Singapore (Singapore Management University), Spain (Instituto de Empresa Foundation), Sweden (The Economic Research Institute at Stockholm School of Economics), Switzerland (Department of Economics, University of Zurich), United Kingdom (Cranfield University, Warwick Business School at the University of Warwick, and Oxford University's Sainsbury Library), and the United States (Economic Growth Center at Yale University, Woodrow Wilson School of Public and International Affairs at Princeton University, and Baker Library at Harvard Business School).

In the context of ZBW's centenary, there is increased public interest in the library's work, offering an opportunity to explain the topics that are important to the organization and research

projects currently underway. What was still very simple in 1919—a *book collection* in the sense of the Greek *bibliotheke*—is much more difficult to explain in 2019.

Several vehicles are used by scientific organizations to communicate with professionals as well as the public, helping them understand the scientific process, specific project findings, and their impact on society. These include brochures, podcasts, animated films, book-a-scientist events, posters, infographics, and exhibitions.

The library decided to mount an exhibition because this format seemed the best to allow visitors to absorb the contents not only intellectually, but also emotionally. ZBW chose an interactive exhibition—a format in space that allows visitors to walk through at their own tempo, focusing on content that appeals to them, to read, watch, hear, and touch. In addition, exhibitions in general enable encounters with other visitors who show that they have similar interests through their choice of location alone.

The ZBW exhibition, "Open UP! How digitization is changing science," was set to travel throughout the anniversary year, 2019. Three people from ZBW's marketing team worked on different elements of the exhibition: (1) curating and editing content, (2) editing and translating German into English (because English is the working language for most target groups and visitors at the chosen locations), and (3) graphic design. In 2017, the curator began conceptualizing and planning the project. After conducting three workshops with selected colleagues in 2018, the team created the exhibition content, including text, graphics, videos, and experiments, as well as the logistical details so that it could launch the exhibit in 2019. For the accompanying events in 2019, two colleagues with expertise in event management assumed the responsibility for organizing conferences, symposia, panel discussions, and official exhibition openings at each venue.

Communication Objectives

The library set several learning goals for its exhibition "Open UP! How digitization is changing science." By providing the relevant background information concerning open science, the library was sure that it could convey these messages:

1. ZBW is active in various research projects in the field of open science, in particular with an information technology and information science perspective.

2. The organization is committed to the implementation of open science in science policy, both at the national and international levels.

3. The organization actively builds the open science ideal by developing new technical infrastructures to facilitate access and remove barriers to research data, such as GeRDI (https://www.gerdi-project.eu).

For visitors to the exhibition, ZBW hoped to convey that it is an organization that is future-oriented, dynamic, innovative, strong, technology-driven and open to partnerships.

ZBW designed the exhibition with two groupings of stakeholders in mind. People inside the scientific community—such as researchers in economics, scientific partners cooperating with us on various research projects, libraries, and funders—possess a keen understanding of scientific inquiry and language (jargon). The exhibition also addressed people outside the scientific community, i.e., the interested public. Through the exhibition, the public was given the opportunity to take a look behind the scenes of science and to obtain background information, for example about the measurement of scientific performance, the handling of research data, or how research findings are transformed into a scientific report or a scholarly journal article.

The locations of the travelling exhibition were chosen to provide maximum exposure for the relevance of scientific libraries in the digital age as well as to showcase some of the new activities scientific libraries have embarked on, including (a) ZBW's own application-oriented research, (b) science policy engagement, and (c) the development of new innovative information infrastructures especially for research data. The exhibition started its travels at the ZBW location in Kiel in February 2019 and was slated to end at its Hamburg branch in December 2019. In between, the exhibition went to Berlin in spring to coincide with ZBW's central international conferences, the Open Science Conference, and INCONECSS – The International Conference on Economics and Business Information (https://www.inconecss.eu). The fourth venue for the exhibition was to be Munich, where Open UP! would be on display from June until September in the *Deutsches Museum*, Germany's most visited museum (1.5 million visitors per year).

Content and Exhibition Design

The exhibition consisted of three displays, which were distinguished by three colors:

- Display 1: Digital connectivity (Blue)
- Display 2: New types of publication (Green)
- Display 3: Finding literature (Orange)

The themes were not arranged sequentially and could be viewed in any order, allowing the visitor the freedom of selecting those aspects of ZBW's work that aligned with their interests.

Elements

Every display consisted of the following elements:

- Data tower for RESEARCH for Open Science (Figure 1) consisted of infographics and experiment stations that presented ongoing ZBW research projects, including data sharing from an individual and social perspective, altmetrics (quality vs. popularity), social media in science, digital publishing, automatic indexing, information overload, artificial intelligence (AI), and recommender systems.

Figure 1. The research towers were designed as book towers and thus bridged the gap to the institution of the library.

- Seating benches with videos on ENGAGEMENT with open science where visitors could watch videos showing ZBW employees explaining their personal engagement in science policy (Figure 2). Topics covered were (a) European Open Science Cloud, (b) the GO FAIR initiative, (c) altmetrics, and (d) the open access transformation.

Figure 2. A total of three video benches with four videos gave visitors the opportunity to engage fully with a narrative.

- Project shows illustrated the BUILDING of open science. The project shows presented three concrete examples of open science infrastructures built or being built by ZBW: EconBiz (https://www.econbiz.de), EconStore (https://www.econstor.eu) and GeRDI (https://www.gerdi-project.eu/).

Figure 3. Project shows demonstrate how services are set up, which partners are involved, and the next stages planned.

Tour through the Theme Islands

This exhibition took visitors to three theme islands: "Digital Connectivity," "New Types of Publications," and "Finding Literature."

Island 1 "Digital Connectivity" display.

Research data are difficult to access. They lie in data silos spread across the country. Digital data collections from different disciplines are not interconnected. There are no reliable infrastructures for the long-term storage of different data. In addition, researchers often do not share their data. The "Digital Connectivity" display showed the infrastructures ZBW is building in Germany, how the sharing of data can be fostered, and how researchers can be supported in their handling of research data.

- "Sharing Research Data" (data tower I) illustrated the individual view of researchers and offered research findings answering such questions as "What needs to be done to foster data sharing?" and "Does the personality of a scientist matter?"

- "Social Relevance of Open Data" (data tower II) presented the social benefit of open data in general, as well as facts about and challenges associated with open research data. Tower II also demonstrated how society benefits from open data in research by creating opportunities for citizens to build public trust in science, by offering economic benefits for the private sector, or by validating data in research papers.

- In the video on the European Open Science Cloud, Professor Klaus Tochtermann, director of ZBW and member of the German Council for Scientific Information Infrastructures, explained current trends in science policy, the parts played by open science and particularly by libraries, and how the digital revolution affects the scientific community.

- In another video, Monika Linne explained the GO FAIR initiative to make data *findable*, *accessible*, *interoperable*, and *reusable*. She also named the initiative's first successes, building an ecosystem for individuals, institutions, and organizations committed to defining and creating materials and tools as elements of the Internet of FAIR Data and Services.

- The project show presented the current status of a linked-up infrastructure for research data that would enable systematic and cross-disciplinary research for research data in the future (GeRDI).

Figure 4. The personality of a researcher determines which incentives work well.

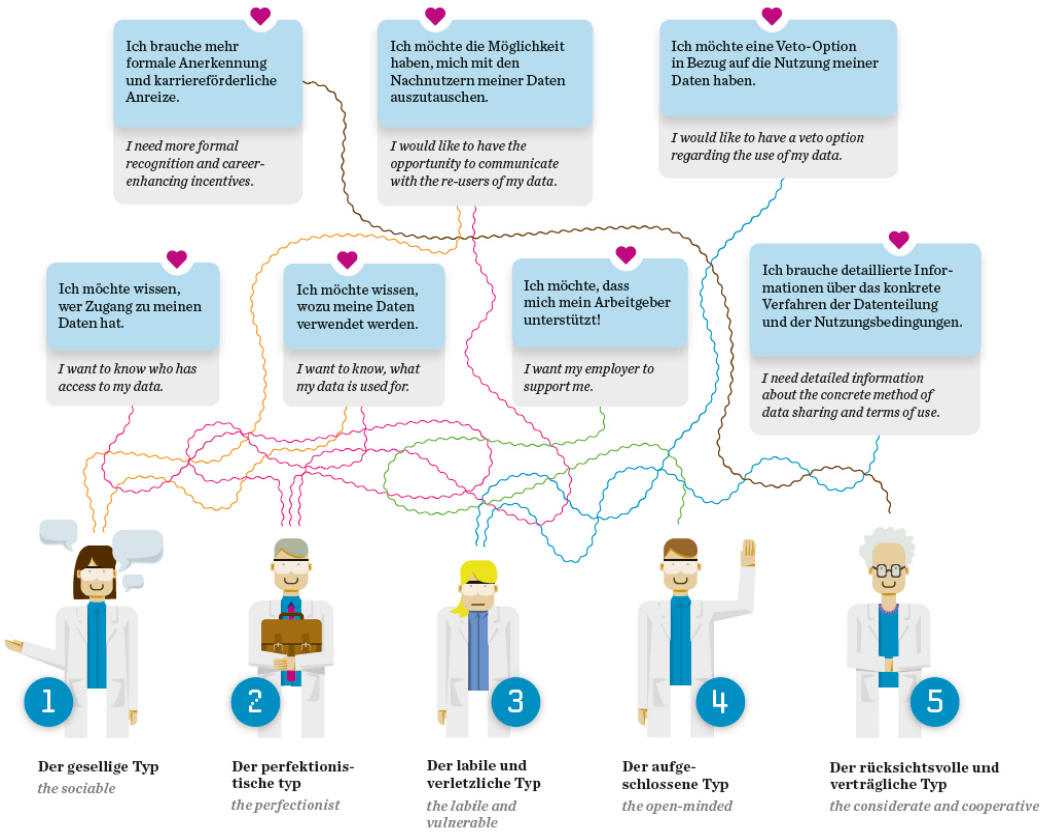
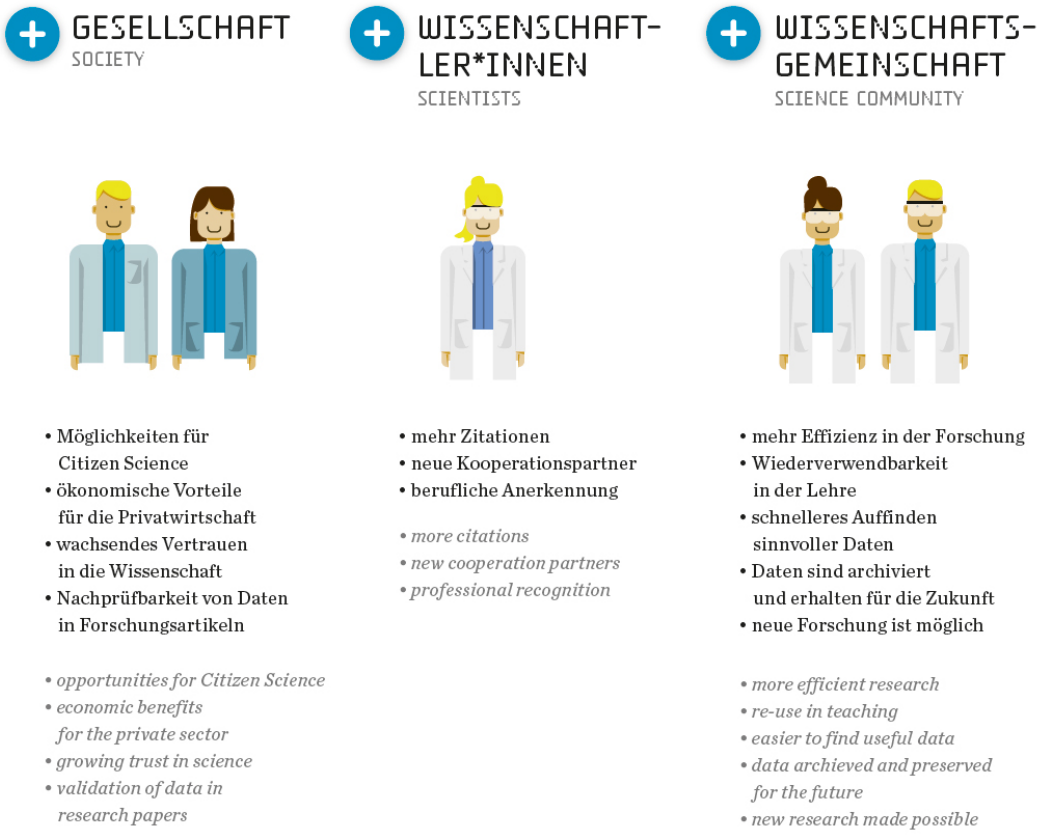


Figure 5. Open research data improve the scientific process. They enable society to benefit more quickly and more broadly from science.



Island 2 "New Types of Publication" display.

ZBW's vision of science is that it be open and accessible.

- What if international law treated scholarly information as public domain?
- What would the world be like if open access were the predominant type of publication in science?
- What would change if scientific impact were no longer measured by the number of publications and citations?

ZBW researches alternative performance indicators and experiments with new paths for fair access to research data. Some of its results were on view in the "New types of publication" display.

- "Social media usage" (data tower I) showed how social media are changing the science system, how researchers use social media in their working lives, and the range of social media in use among scientists.

- "Altmetrics – A Fairer Assessment of Scientific Output" (data tower II) highlighted the deficiencies in today's criteria for measuring scientific impact and how scientific impact can be measured more comprehensively in the future. Here visitors could play researchers themselves in an experiment by assessing and organizing publications based on corresponding metrics.

- "The Market for Academic Publications in the Digital Age" (data tower III) addressed the challenges users face accessing research findings that are published behind expensive paywalls. The traditional system of academic publishing limits readership to institutions with wealthy libraries, while the general public without library access are shut out.

- In the video on altmetrics, Professor Isabella Peters explained how output is measured in the current science system, why this is no longer adequate, what output assessment could look like in the age of open science, and why she herself is active in this field.

- The project show presents EconStor, an established international infrastructure for free publishing in economics which enables both researchers and citizens to read economic research findings online for free and to participate in scientific discourse.

Figure 6. How would you rate this article? An experiment from the research project metrics of ZBW's Web Science research group.

Island 3 "Finding Literature" display.

About every nine years, the number of publications worldwide doubles. In economics alone, there are more than 50,000 publications every year (Bornmann & Mutz, 2015; Mabe & Amin, 2001; Möller, 2015). Neither libraries nor researchers can cope with this flood without resorting to automation, filters, algorithms or recommendation systems. The "Finding Literature" display showcased ZBW's research in the domain of artificial intelligence, including how the organization indexes large quantities of data, automates intelligent behavior, and designs useful recommendation systems.

- "Indexing" (data tower I) showed how the content of economics literature can be described efficiently with automated procedures.

- "Artificial Intelligence" (data tower II) showed how a machine compares texts automatically in a way that tells readers whether a text offers new information for them.

- "Information overload" (data tower III) explained the trends in knowledge creation, which countries produce the most publications, how the number of scientific journals is increasing, and how many publications are available worldwide. Visitors could emulate researchers in an experiment and decide for themselves which publications were scholarly, and which were not.

- Video: The digital age sets new requirements for libraries. Access to information must be instantaneous. Information must be of high quality and high relevance. Information must also be available freely and sustainably. In the video on digital transformation, Thorsten Meyer explained how digital transformation takes place at ZBW and his own personal engagement in this.

- The EconBiz project show presented ZBW's research-based solution that enables access to scholarly literature in economics designed for use by professional economists as well as the public. EconBiz access is transparent, independent of commercial interests, simple, and free of charge.

Figure 7. Visitors can watch six video tutorials explaining how to write scientific papers.

Dissemination

ZBW's outreach was a dual-track effort from the start, with a physical touring exhibition as well as an online presence that included both a web page and YouTube videos.

Analog Dissemination

The touring exhibition, "Open UP! How Digitization Changes Science," debuted at the official ceremony marking the 100th anniversary of ZBW on February 1, 2019 (Figure 8). The exhibition proceeded to venues in other cities, including Humboldt University in Berlin (Figure 9). In addition, ZBW organized events directed at specific audiences, such as a panel discussion for librarians ("Digital Librarian") and a symposium for economists ("Digital Economics—Opportunities and Challenges"). Additional events were planned for the end of 2019, including a panel discussion on the significance of libraries in the year 2050.

ZBW offered special guided tours for participants during its international conferences in Berlin (Open Science Conference, March 19–20, 2019, and the INCONECSS – International Conference on Economics and Business Information, May 6–7, 2019). Additional tours were planned for the international conference "Semantic Web in Libraries," November 25–27, 2019, in Hamburg. An extensive tour program at the guest venues for different target groups enabled immediate feedback from the exhibition visitors. All visitors could take home a free accompanying booklet, "What Is Open Science," that briefly explained what open science is, why it is necessary, and the challenges it faces.

Figure 8. ZBW Director Klaus Tochtermann explains the GeRDI project show to the ceremony's VIP guests.

Figure 9. Exhibition opening at the Humboldt University of Berlin on March 12, 2019.

Digital Dissemination

The central communication element for the exhibition was the landing page of its website, (100years.zbw.eu/openup) which brought together all content associated with the exhibition, text and video, as well as a calendar for all events and tours. The web page also depicted various elements of the exhibition online, such as the videos, dossiers documenting information from the data towers, the accompanying booklet, and a literature list available for download.

ZBW posted the four exhibition videos on YouTube:

- European Open Science Cloud: Open Research Data across all Disciplines
- Altmetrics: A Fair Evaluation of Quality
- GO FAIR Initiative: Open Research Data for All
- Digital Transformation. Open Science is the Future

As of May 14, 2019, the videos had a combined viewership of 51,219. ZBW also promoted the exhibition and the additional online materials on numerous social media channels. An audio tour of the exhibition (in German) is available via Open Science Radio.

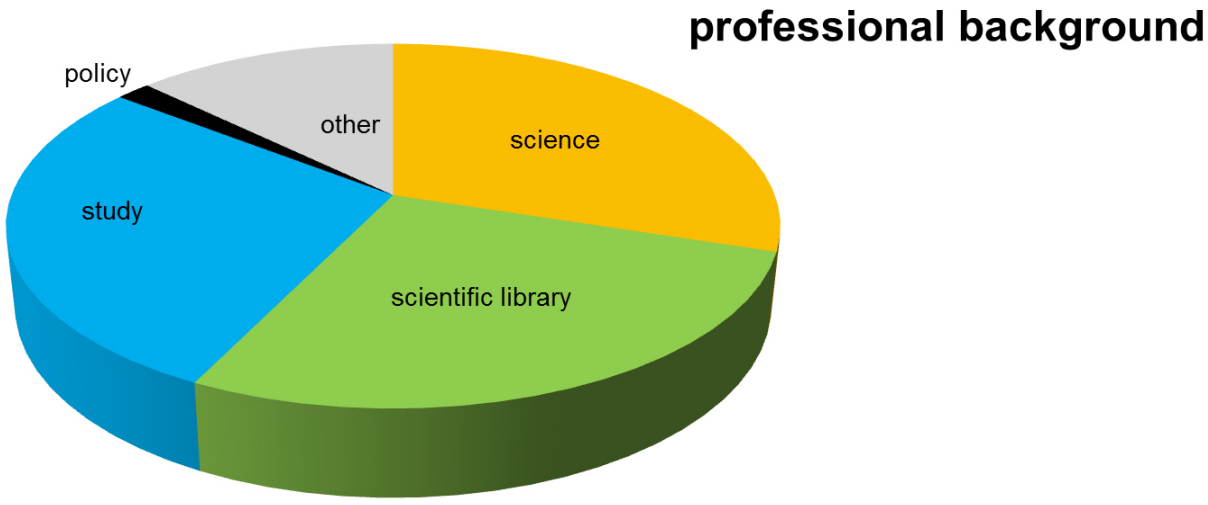
Evaluation

To determine whether its intended communication goals were achieved, ZBW requested feedback from visitors of the exhibition so that it could assess the effects that the exhibition had on their knowledge about and attitudes toward open science and digitization in science. All guided tours began and ended with a survey designed to explore visitors' exposure to and understanding of open science, the digitization of research and research processes, and changes in academic scholarship caused by digitization. The questionnaire also inquired about visitors' thematic interests in various aspects of scientific work. After the guided tour and their individual tour of the exhibition, guests were asked about their learning outcomes. An interim evaluation based on feedback received as of May 9, 2019, and preliminary conclusions based on these initial interim results are presented below. A final assessment was planned for 2020, after the touring exhibition ended.

Who Was Interviewed?

The respondents assigned themselves to the following groups: science and research (29%), students (28%), scientific library (27%), politics (2%), and others (13%).

Figure 10. Professional background of feedback respondents.



Of all those surveyed, 87% had heard the term *open science* prior to visiting the exhibition. Not surprisingly, more than 80% of individuals from scientific environments (i.e., research and scientific libraries) indicated that they were personally affected or very much affected by the digitization of science. In all these cases, however, their own knowledge of the subject was rated lower than the extent to which they themselves were affected by digitization.

Of the scientists interviewed, 83% considered themselves to be affected or very affected by the digitization of science. Of these:

- More than half (58%) stated that they place their knowledge in the lower to middle range.
- Over a third (37%) rated their knowledge as high and 5% as very high.

Of the non-scientists, only 73% were severely affected or affected by the digitization of science. Half (49%) rated their knowledge as low to medium, 49% as high, and 2% as very high.

What Effects Did the Exhibition Have?

Regardless of their previously expressed interest in the topics of digitization and open science, 50% of all respondents who visited the exhibition more or less agreed with the statement that their attitude towards open science had changed positively. In addition, the following learning successes were observed as a result of visiting the exhibition:

- Respondents who fully or almost agreed that they had learned something about sharing research data through the exhibition totaled 78%; 14% partially agreed. Altogether, 92% of the respondents indicated positive effects.

- Respondents who fully or almost agreed with the statement that they learned something about the evaluation of research achievements through the exhibition numbered 67%; 24% partially agreed. In total, 91% of respondents indicated positive effects.

- Respondents who learned something about the provision of literature by libraries totaled 81% (approximately 61% fully agreed and 20% partially agreed).

- Twenty-two percent of respondents fully agreed with the statement "The exhibition has increased my knowledge about digitization in science," 39% rather agreed, 24% partly agreed. In total, 85% of respondents positively indicated that they had learned through the exhibition.
- In response to a statement that the respondent's attitude toward digitization in science has changed positively, 17% fully agreed, 34% rather agreed, 27% partly agree. In total, 78% of the respondents noted positive effects.

- Correlated with the stated prior knowledge, the following observations were made: 68% of all guests with little prior knowledge said that they had a high increase in knowledge. Seventy-four percent of scientists and 71% of persons from libraries likewise noted an increase in digitization knowledge. Regarding people with a high level of prior knowledge, 50% of all respondents said that they had a high level of learning success; among researchers it was also 50%, and among library staff 39%.

- The increase in knowledge of "sharing research data" and "evaluating research performance" was similar in terms of previous knowledge about digitization.

- On the subject of sharing research data, 88% of researchers with a greater interest in open science reported learning success, as opposed to 80% of those with less interest.

- When it came to the evaluation of research performance, 76% of those who were more interested in it recorded a high increase in knowledge as compared to 60% of those who were less interested.

In conclusion, the vast majority of exhibition visitors learned something about digitization in science and open science in general and, in particular, about sharing research data, measuring performance in science, and making literature available through libraries.

Exhibition Presentation

Overall, the exhibition was rated very highly. All aspects explored in the survey received 70% to 80% approval:

- Eighty percent of the guests said they could easily find their way around.

- Seventy-six percent said the content was visually appealing.

- Seventy-seven percent found the complex scientific content to be comprehensibly explained.

When asked to rate their overall impression, 43% of respondents gave 4 points out of 4, 34% gave 3 points, and 16% rated it medium well with 2 points. Only 5% indicated they did not like it and gave 0 points. Respondents who liked the exhibition and gave 3 or 4 points of 4 totaled 77%. Among the researchers, 89% gave 3 and 4 points, among the librarians 75% and among the students 64%. Overall, 89% of all guests would recommend the exhibition to others.

Conclusion

Based on the interim evaluation, various conversations during the guided tours, and other feedback, the exhibition as a communication vehicle, as well as its concise and diverse components, was evaluated very positively.

An exhibition offers a very good opportunity to engage in dialogue with various stakeholders, be it on the fringes of conferences or panels or at specially created occasions such as exhibition openings or guided tours. On the one hand, an exhibition can focus on individual themes and, on the other hand, the spectrum of one's own work can be expanded in its many facets.

It is also very interesting to observe how people spontaneously start conversations during tours. The exhibition brings together people from different contexts who rarely come together in everyday life. Conversations with these diverse groups enrich the view of one's own library immensely and are a gain for public relations workers.

One final and surprising discovery is that the exhibition offered excellent opportunities for ZBW's own staff to find out what their coworkers did or to reflect on their own work and to discuss digital transformation with their colleagues. In particular, the guides reported that they had fruitful exchanges with external colleagues and partners about changes, projects, and successes at ZBW.

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