



David against Goliath: How a University Cloud Succeeds in the Niche of Higher Education – a User Survey.

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Abstract

In the discussion about digital sovereignty, an important goal of the EU, there is always the fear that no one would stand a chance against the big giants from the U.S. which dominate the cloud market thanks to early starts, huge resources and network effects. However, the state-funded open source project “sciebo” proves the opposite, at least in the higher education sector. High data protection is a central argument for using a private cloud service at universities, but this alone does not make it competitive. University-specific functions and integrations – for example in the area of digital teaching or research data management – can be a unique selling point, but for a majority of students and employees the basic sync and share functions seem to be sufficient. So how can a university cloud service compete with commercial offers and what can make it successful in the long term? In a cloud landscape dominated by big players like Microsoft, Apple or Google, who move their established services to the cloud and encourage customers to also use their cloud storage with the arguments of a central account and seamless linkage with their other products, this question needs to be addressed to those at the front line: the users. To investigate the above question, we conducted a user survey, taking the university cloud service “sciebo” as an example, which has been in use at numerous higher education institutions in the German state of North Rhine-Westphalia since 2015.

1 Introduction

In the last decade, cloud services have not only become established in the private sphere, but also in higher education, where they are used by students and employees to synchronize data on different devices, to exchange files and to work on documents simultaneously. In order to meet the specific data security requirements of universities, to ensure further development with a focus on usage scenarios in research, teaching and studying, and in the pursuit of digital sovereignty, the private cloud solution

“sciebo” was launched with public funding in 2015 and is now jointly operated by a consortium of 38 higher education and research institutions (Vogl, et al., 2016). Currently, the ongoing project “sciebo Research Data Services” aims to create low-threshold services for the management of research data by developing a bridge between the sciebo working environment and established exchange, archiving and publication services (Vogl, et al., 2019).

The case of sciebo presented an excellent opportunity to observe the diffusion of a technical innovation from the beginning in a well-controlled environment. At the same time, the case differs from the adoption of cloud systems for private use and also for professional use in organizations due to the special circumstances in the higher education sector where large parts of the potential user base (primarily students, but also academic staff) change regularly. Adoption processes therefore take place cyclically, with new potential users bringing new characteristics and experiences and finding new conditions in the higher education landscape as well as in the cloud landscape.

1.1 Theoretical Framework

From a theoretical point of view, the Innovation-Decision Model originating from Diffusion of Innovations Theory (Rogers, 1983) and the Technology Acceptance Model (TAM) are particularly suitable to provide a framework for the study.

The Innovation-Decision Model according to Rogers represents a process-oriented view of the adoption process, “through which an individual (or other decision-making unit) passes from first knowledge of an innovation to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation and use of the new idea, and to confirmation of this decision” (Rogers, 1983, p. 20). The five ideal-typical stages are 1) knowledge, 2) conviction of the benefits, 3) usage decision, 4) implementation, and 5) confirmation. The process is influenced by the characteristics of the innovation, by the characteristics of the recipient, by communication about the innovation and by factors of the social situation (Rogers 1995: 20f.).

The Technology Acceptance Model (TAM) goes back to Davis (1985; 1989), but has been revised several times, notably in form of TAM 2 (Venkatesh & Davis, 2000; Venkatesh, 2000) and TAM 3 (Venkatesh & Bala, 2008). It is also the basis for the widely referenced Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003). The TAM is a causal analytical model that explains how users accept and adopt technologies in an organizational context. The decisive variables here are perceived usefulness, defined as the expected increase in performance through the use of a technology, and perceived ease of use, described as the effort expected for using a technology – whereby both perceptions are made by the decision-making individual (Davis, 1989).

While we have already investigated the adoption of sciebo on the basis of statistical data (Vogl, et al., 2016), we did not focus on decision criteria from the user’s point of view. This study fills in this gap, taking into account central elements of the two models.

1.2 Literature Review

Various studies have looked at the diffusion of cloud computing in different environments, often with a particular focus on driving and hindering forces. However, cloud computing is a broad field that includes service and architecture models such as Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS). Consequently, existing research covers a very wide range of usage scenarios. A large proportion of these studies deal with the acceptance, adoption and usage of cloud computing services by consumers and the factors that moderate these processes (Bachleda & Ouaziz, 2017; Burda & Teuteberg, 2015; Changchit & Chuchuen, 2018; Bhattacharjee & Park, 2014; Moryson & Moeser, 2016). Usage continuance was investigated by Jun, Lee and Jeon (2014); discontinuance issues, on the other hand, were surveyed with regard to the sciebo cloud storage service (Stieglitz, Wilms, Rudolph, & Vogl, 2018). Other researchers address the adoption processes in

organizations, examining for example small and medium-sized enterprises (Gupta, Seetharaman, & Raj, 2013; Carcary, Doherty, & Conway, 2014), specific industries and professional groups (Aharony, 2015; Oliveira, Thomas, & Espadanal, 2014; Lian, Yen, & Wang, 2014; Lin & Chen, 2012), and cross-organizational use in supply chains (Cegielski, Allison Jones-Farmer, Wu, & Hazen, 2012).

Security, privacy and trust issues form another independent area of scientific interest, with studies addressing the subject both as a challenge from the providers' point of view (Khan & Malluhi, 2010; Hussein & Khalid, 2016), and as a decision criterion from the users' point of view (Garrison, Rebman Jr., & Kim, 2018; Orehovački, Etinger, & Babić, 2017).

In the (higher) education sector cloud computing can be highly beneficial, allowing students, teachers, and researchers to flexibly use software in virtual environments (without having to meet the necessary hardware requirements on their own devices), fostering new forms of exchange and cooperation, and creating a basis for compute-intensive research processes. Cost savings in software, hardware and maintenance are another advantage. Consequently, there is strong scientific interest in this topic and especially in adoption processes among students and employees as the best technology is of no value unless it is used. González-Martínez, Bote-Lorenzo, Gómez-Sánchez and Cano-Parra (2015) provided a state-of-the-art survey on cloud computing and education, reviewing 112 scientific works published on this issue up to 2012. A more recent literature review on the benefits and challenges of cloud computing adoption and usage in higher education comes from Ali, Wood-Harper and Mohamad (2018). There is also an increasing number of surveys on the use of cloud computing for alternative styles of learning such as collaborative learning, mobile learning, e-learning or blended learning (Martin, Hugues, & Puliatte, 2019; Arpaci, 2019; El Mhouti, Erradi, & Nasseh, 2018; Al-Samarraie & Saeed, 2018).

2 Research Design

The study was conducted as a quantitative standardized online survey, as this method is well suited for large samples and allows questions on opinions, attitudes, evaluations and knowledge as well as on usage behavior and demographic characteristics. The questionnaire developed for the study consisted of a total of 19 questions that can be grouped into five thematic blocks: 1) demographics, 2) awareness and use of cloud services, 3) use of sciebo, 4) evaluation of sciebo, and 5) user suggestions. The survey population included all potential users of sciebo, i.e. all employees and students of the 38 participating institutions. However, in terms of user behavior and evaluation of the service, only current users and those who have stopped using the service but were still eligible were relevant, whose number amounted to approximately 235,000 at the time of the study. Within this group, the highest willingness to participate was also expected. The survey was conducted in December 2021 with a survey period of two weeks. The number of completed questionnaires included in the analysis was 6,292, of which 871 were answered by employees in technology and administration, 2,047 by employees in research and teaching, and 3,249 by students (the remaining 125 stated "other"). A previous quantitative and standardized sciebo user survey from 2015 with a total of 15,401 participants was used to interpret some results in a year-on-year comparison.

3 Findings

Within merely a decade, cloud computing, and cloud storage in particular, have seen an enormous rise in demand and diffusion. The cloud storage market, however, is quickly becoming a commoditized market with homogenous products, making it vital for providers to precisely understand changing customer preferences in order to develop their services accordingly (Burda & Teuteberg, 2016). Against

this background, the following chapters show the users' assessment of the usefulness and ease of use of the university cloud storage service sciebo and reveal the extent to which such university services can and have to compete with commercial competitors. The results help to align the further development of the service with user needs and thus not only position it competitively, but also differentiate it from other offers through special features geared towards the university community.

3.1 Commercial Cloud Providers as a Benchmark

As a university service and according to its terms of use, sciebo is only intended for use in study, research and teaching. Private use is not permitted, although it cannot be ruled out. However, cloud storage services are also widely used for private purposes (especially backup, availability and exchange of data), so commercial services are likely to be used in parallel and serve as a benchmark for evaluating sciebo.

Comparing sciebo's level of awareness and level of usage from 2015 and 2021 with the values of the widely used commercial services Dropbox, Google Drive, Apple's iCloud and Microsoft's OneDrive reveals an interesting development: In 2015, the majority of respondents were already familiar with the services mentioned, with Dropbox as the pioneer having the highest level of awareness at 99 percent and the then new service sciebo the lowest at 65 percent. In 2021, the values have converged. Dropbox is still the best-known provider (98 %), but the other four services were able to catch up and are also above the 90 percent mark.

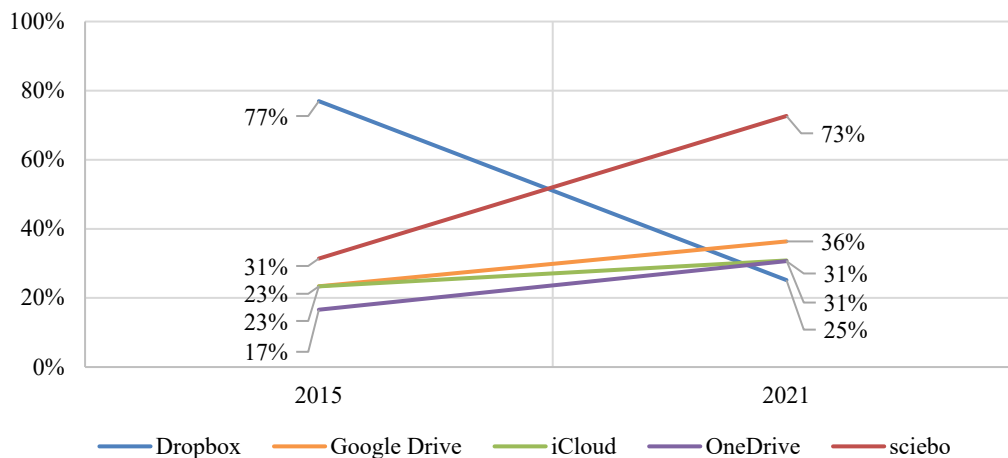


Figure 1: Usage level of different cloud services 2015 and 2021 (nmin=6,236, nmax=13,903)

What is particularly interesting, however, is that this development is not reflected in the usage rate (Figure 1). While the cloud storage services of the three giants Microsoft, Google and Apple have slowly gained active users, massive changes are visible for Dropbox and sciebo. As recently as 2015, Dropbox was the market leader within the group of respondents with a usage rate of 77 per cent – a figure more than double that of its closest competitor sciebo (31%) and multiple times that of Google Drive (23%), iCloud (23%) and OneDrive (17%). In 2021, the lead has not only melted away completely, Dropbox even finds itself last in the ranking with a usage rate of 25 percent. Sciebo, on the other hand, seems to have found its niche as a cloud service in the higher education sector. While 31 percent of respondents said they actively used sciebo in 2015, this figure has doubled in 2021 with 73 percent of respondents saying that they actively used sciebo. In a direct comparison of the status groups, the opposing development of Dropbox and sciebo is clearly recognizable among both employees and

students, but at different levels. Among the employees surveyed in 2015, sciebo (60%) was already similarly widespread as Dropbox (69%), while students clearly preferred Dropbox (79%) to sciebo (26%). In 2021, sciebo reaches the top spot among employees with 90 percent, while only 28 percent still use Dropbox. Among students, sciebo spreads at a lower level, reaching 57 percent in 2021. Dropbox's decline, on the other hand, is even more dramatic in this group, with only 22 percent still using the service in 2021. Of course, these figures have to be taken with a grain of salt, as it can be assumed that sciebo users are more likely to participate in a survey on sciebo than non-users, even though both groups were approached. In order to classify the results, it is therefore worth taking a look at the statistical number of active sciebo users, which has risen from 40,000 one year after launch in February 2016 to 238,000 in February 2022.

In general, it can be said that sciebo has arrived in the niche of the higher education sector. This aspect is also supported by the main purpose of use that the respondents indicated for the different services (Figure 2). A comparison of mean values (whereby 2 corresponds to exclusively private use and -2 to exclusively official use) shows that respondents use all commercial services primarily for private purposes ($\bar{x}_{iCloud}=1.23$, $\bar{x}_{Dropbox}=0.75$, $\bar{x}_{GoogleDrive}=0.74$, $\bar{x}_{OneDrive}=0.13$), while sciebo ($\bar{x}=-1.40$) is clearly used for university purposes (study, research, teaching).

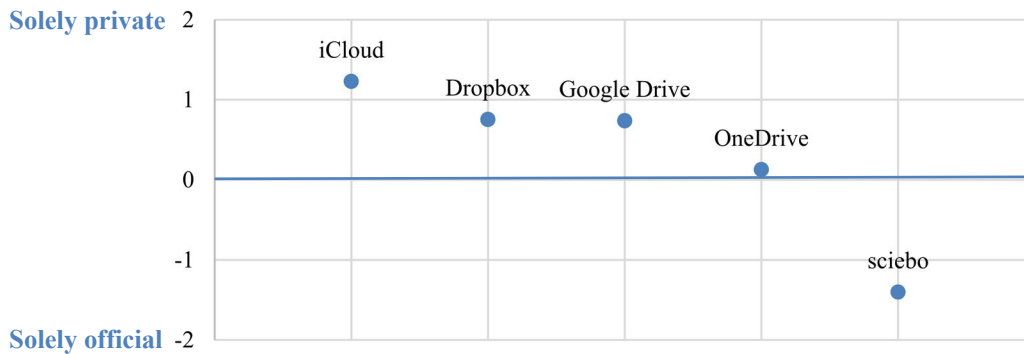


Figure 2: Usage purpose of different cloud services 2021, mean values ($n_{min}=1,569$, $n_{max}=4,550$)

Nevertheless, the overall competitive situation has intensified, meaning that users are increasingly using several services in parallel. While Dropbox was the benchmark in cloud storage just a few years ago, none of the commercial services currently seems to be the sole frontrunner. The data clearly shows how quickly the market situation can change and how important it is to keep an eye on user needs and the further development of other providers. The next chapter shows how sciebo performs in the evaluation of functions and features from the user's point of view – in comparison with competitors.

3.2 Usefulness and Future Development

In order to assess the usefulness of a service, it is worth looking at the overall evaluation by users first. A high level of satisfaction is evident for sciebo, as 28 percent rate the service as very good and 54 percent as good. Another 14 percent selected “fair” and only 4 percent consider sciebo to be poor or very poor. The mean value (whereby 2 corresponds to “very good” and -2 to “very poor”) for 2021 ($\bar{x}=1.06$) is thus only slightly below that of 2015 ($\bar{x}=1.23$) and the distribution among the five answer options is also similar. The participants' assessment of sciebo's basic functions and offerings proves to be solid with room for improvement: sharing with $\bar{x}=1.03$, the client with $\bar{x}=0.88$, the web interface with editor with $\bar{x}=0.66$, support and instructions with $\bar{x}=0.53$, and the app with $\bar{x}=0.50$.

Furthermore, the following of sciebo's features were evaluated in relation to those of other services known to the users by means of semantic differential with a 5-level scale: security, storage space,

reliability, range of functions, handling, and innovativeness (Figure 3). The results show that first and foremost the aspect of data security can be considered a unique selling point of sciebo ($\bar{x}=0.93$). But the service also has an edge over the competition when it comes to storage space ($\bar{x}=0.51$) and reliability ($\bar{x}=0.35$), while the differences in the range of functions ($\bar{x}=0.15$), handling ($\bar{x}=0.07$) and innovativeness ($\bar{x}=-0.07$) are only minor.

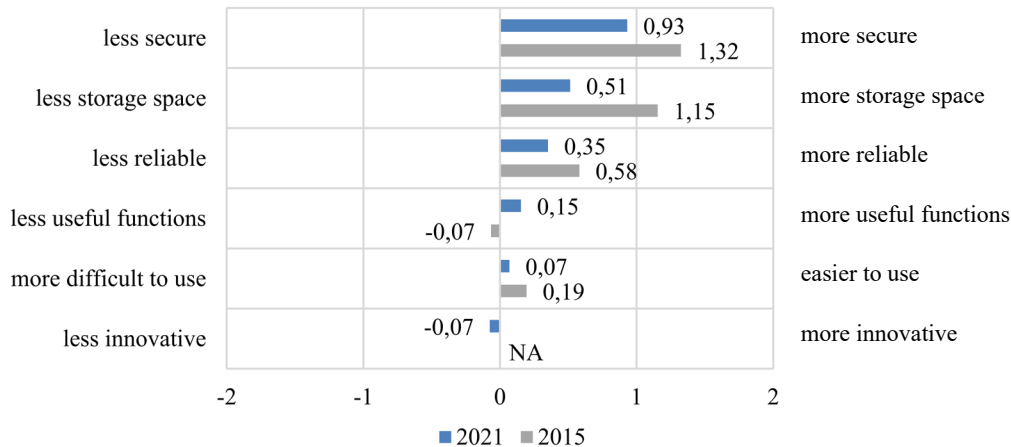


Figure 3: Comparative evaluation of sciebo's features, mean values ($n_{\min}=4.520$, $n_{\max}=4.568$)

When comparing the status groups, it is worth taking a closer look at the best rated features, as this is where the differences are greatest. For one, employees tend to perceive sciebo as more secure than students ($\bar{x}_{\text{employees}}=1.07$ compared to $\bar{x}_{\text{students}}=0.78$) – possibly because they work with more sensitive data and also have to follow stricter guidelines from their employer. When it comes to storage space, the fact that students only receive 30 GB, while employees can activate 500 GB on their own and also have the option of requesting project boxes with an even larger volume, obviously has an impact. Accordingly, it is not surprising that students rate the storage volume of sciebo significantly lower than employees ($\bar{x}_{\text{employees}}=0.70$ compared to $\bar{x}_{\text{students}}=0.30$). In addition, commercial providers usually offer their customers more free storage space today than 5 to 10 years ago. This could also be the central reason why sciebo scores significantly worse on this aspect compared to 2015 ($\bar{x}_{2015}=1.15$), where volume was still considered one of sciebo's selling points. However, a look at the graph shows that this seems to be an overall trend, as almost all features are affected and their lead has decreased since the launch of the service. Even the still strong argument of higher data security is not spared ($\bar{x}_{2015}=1.32$). A better result can only be seen in the range of functions ($\bar{x}_{2015}=0.15$), where sciebo seems to have improved its usefulness. In the comparative overall assessment of sciebo, the service still performs well ($\bar{x}=0.38$), although the lead has decreased compared to 2015 ($\bar{x}_{2015}=0.73$). Against the background of the relatively constant (non-comparative) overall rating described above, it can be assumed that this trend is due to changes on the part of the competitors. A closer look at their development in recent years could help to clarify the exact reasons; this could be the subject of further research.

Another revealing factor with regard to the usefulness of a service is the users' demands for further development. With regard to sciebo, the survey participants were quite conservative when asked about the future of the service: Only 22 percent would like to see further development with a focus on extended usage scenarios, in the sense of integrating communication, messaging and groupware tools; 78 percent, on the other hand, preferred to keep the focus on synchronization and sharing with the aim of improving usability and performance. The widespread reluctance of users to embrace possible innovations that would significantly change sciebo may also be related to fears that this would make the services less easy to use. Davis (1989, p. 320) already pointed out that the performance benefits of

usage can be outweighed by the effort of using a technology. The issue of ease of use is therefore addressed in the next section.

3.3 Ease of Use and Exploitation of Potentials

As already mentioned in the previous section, from the user's point of view, sciebo is just as easy or difficult to use as the cloud services of other providers. However, this still says little about whether use is in fact perceived as easy or difficult. A direct indicator is provided by the question whether sciebo's ease of use needs to be improved and 31 percent of the respondents agree. This is consistent with an indirect indicator, their self-assessed knowledge of sciebo: 75 percent of users rate their skills as good or very good, while 25 percent feel rather unconfident in their use. Moreover, the majority of those respondents who do not use sciebo ($n=765$) state that the main reason for non-use is that they have not yet had time to familiarize themselves with sciebo (53%). It seems likely that the perceived effort is too high. Consequently, sciebo already has a high level of user-friendliness, but ease of use could still be simplified for a relevant part of the user community. Here it is important to find out whether service enhancements are actually necessary, or whether targeted communication and support measures can already bring about decisive improvements for this group.

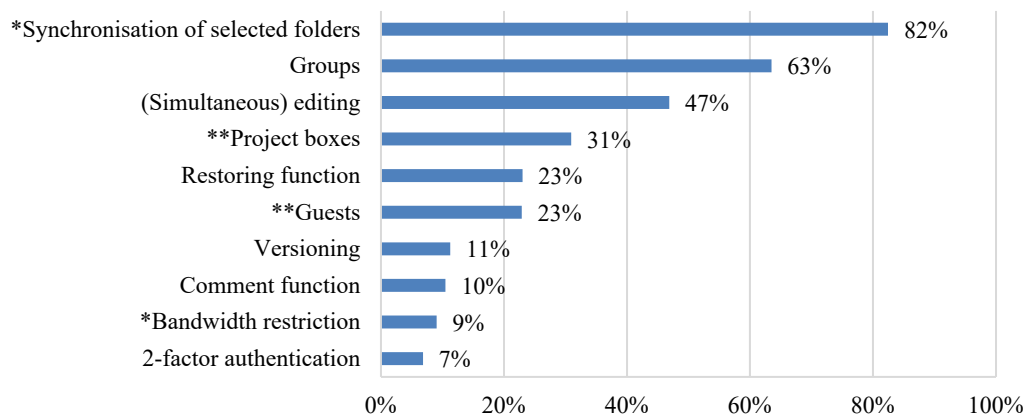


Figure 4: Use of advanced functions, multiple answers ($n_{\min}=2,608$, $n_{\max}=4,566$; *only client users, **only employees)

Some insights into this issue are provided by a look at the extent to which the potential of sciebo is exploited. Interesting, for example, is the use of the client, which offers an enormous improvement in comfort when synchronizing data (compared to the exclusive use of the web interface). Although clients are a standard feature of cloud services, only 61 percent of respondents have installed the client on at least one of their PCs or laptops. Within the group of employees it is 68 percent, while just half of the students (51%) make use of it. Looking at advanced functions with a relatively low level of complexity, it becomes apparent that only few users tap the full potential of sciebo (Figure 4). Of the client users, most make use of the option to synchronize individual folders instead of their entire sciebo account (82%), but this is an optional step in the set-up process, so users are directly confronted with this function. In contrast, only 9 percent have made use of bandwidth limitation for uploading and downloading, a setting that can be adjusted in the client menu at any time. Functions that facilitate collaborative work in the web interface are still among the most frequently used: 63 percent of respondents create their own groups to simplify the sharing process, 47 percent edit documents (together with others) in the editor and 10 percent make use of the comment function. Versioning and restoring deleted documents, i.e. functions that provide back-up in the event of mistakes in both individual and

collaborative working, are only used by a minority (11% and 23% respectively). Project boxes and guest accounts as functions for employees that are geared towards special demands in working groups (with external persons) are used by 31 and 23 percent of the employees surveyed. Only 7 percent of users rely on increased security through 2-factor authentication. Eventually, the results on advanced features show how usefulness and ease of use go hand in hand: On the one hand, the question arises whether the functions are not used because they appear too complicated to the users; on the other hand, an easy-to-understand communication of the functions could increase the perceived usefulness.

4 Conclusion

The results of the study are particularly noteworthy in light of the discussion under the heading of “digital sovereignty”, which was elevated to a strategic goal of the European community under the German EU Council Presidency in 2020. The aim is to counterbalance the monopolistic giants from the U.S., particularly in the cloud sector, such as Microsoft, Google and Apple, by using open source. The example of sciebo shows that this battle of David against Goliath does not always have to end in favor of the giants. By limiting itself to a specific niche (academic cloud) and consistently focusing on user needs in this environment (e.g. data protection), the service is not only able to hold its ground against increasingly strong competition, but even oust it from the university environment (like Dropbox). This gives cause for optimism for other digital sovereignty projects as well. It must be said, however, that the success of sciebo may also be due to regulatory requirements imposed by universities on the use of commercial cloud services. However, the high user satisfaction speaks against this argument. For the future, it is important to maintain and increase the usefulness and ease of use and, if necessary, to mediate between the two with communicative measures.

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