

Open Source Monitor

Research report 2019

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Preface

Open source software shapes the everyday life of many people – mostly without them knowing it. The internet as you know it and use daily would not work without open source software, neither would most smartphones. However, nowadays, most large companies employ open source software deliberately. This was the result of a survey of more than 800 companies in Germany, with 100 or more employees, commissioned by the digital association Bitkom with the support of nine partners. We summarize the results in this »Open Source Monitor 2019«. This is the first time we conducted the survey and want to provide a first insight into the extent of application of open source in Germany and to what extent companies participate in the development of open source.

Software as part of an open source licence agreement can be run freely, as its source code is open for analysis and adaptation and can be passed on in modified versions. This approach permits numerous different developers – as well as economists, scientists, and society in general – to work on the same problem. Thus, each party benefits from the ideas and solutions of one another, which they, in turn, can improve and develop further. It is no coincidence that the European Gaia-X project for cloud and infrastructure, presented at the Digital Summit, mentioned Open API, Open Standards, Open Documentation and Open Source as basic principles crucial to success.

Open source is a decisive factor in shaping digitalisation successfully in Germany based on three aspects.

First, most IT systems will likely contain an open source component. The spectrum ranges from operating system for mobile devices, servers and routers to specific applications for photo or video editing, to traditional office applications. Open source is often the basis for commercial software.

Second, existing open source software can significantly simplify the development of new and existing software. Developers can fall back on a variety of components that have been used and tested – such as modules and libraries – thus increasing the pace of development. This is particularly important for new digital developments and technologies such as Artificial Intelligence or blockchain since the pace of innovation is particularly high there. Since there are no licence costs for open source, the development costs simultaneously decrease.

Third, open source fulfills a social and ethical component. It is about collectively sharing and passing on knowledge. The idea of open source is to share any improvements and further developments made with the community and society – the same way that you benefit from open source software. Cooperation, collaboration, and sharing are fundamental values of the open source movement.

The »Open Source Monitor 2019« shows that 75 percent of companies show interest in open source and are open to this topic. Only 4 percent state that they are sceptical or dismissive of open source. However, only 1 out of every 5 companies has an open source strategy, and more than 75 percent have no strategic approach. And not even a third of companies participate in the development or further development of open source software. Looking at Germany as a business location, the greatest potential of open source lies untapped.

If open source is better utilised, it can contribute significantly to the recovery and preservation of our digital sovereignty.



Achim Berg, Bitkom President

Methodology

Open source software (OSS) has long been an integral part of the information and communication technology sector (ICT), while also advancing into one of the most decisive drivers of digital transformation. Nowadays, there will be scarcely any IT application area without open source alternatives next to proprietary offers, or in which open source software has not also become the standard. Moreover, it is likely that nearly all IT systems, as well as digital solutions in general – from drones to coffee machines – contain at least some open source software components. Open source has become increasingly important in the software development process and has become a tool for every software developer.

To what extent companies in Germany consciously rely on open source software is the focus of this study. The »Open Source Monitor 2019« is intended to provide an overview of the use of open source software in the German economy for the first time, which also provides answers to the following questions:

- To what extent do companies use open source software or participate actively in the (further) development of open source software?
- From the companies' perspective, what are the advantages of using or participating in open source software? What are the disadvantages?

- What is the contribution of open source software to new products, services, processes, and digital transformation?
- How do companies deal with open source software compliance?

In our aim to answer these and additional questions, the project consortium decided to conduct a company survey to research the strategic and conscious use of open source software within German companies. In collaboration with nine sponsors of the study – Boehmert & Boehmert, DataStax, Osborne Clarke, PricewaterhouseCoopers, Red Hat, SAP, SUSE Linus, Synopsys Software Integrity Group and the Berlin Institute of Technology (Chair of Innovation Economics), the digital association Bitkom, as well as the Bitkom Research GmbH – an approach was developed based on a company survey representative of the German economy. The specialist expertise of the project consortium aided the design of the standardised questionnaire. Specially trained phone interviewers conducted the Computer-Assisted Telephone Interviewing (CATI) in the months of July and August 2019.

As part of the company survey, 804 companies were selected, according to company size and industries, with at least 100 employees in Germany.

The stratification of these random samples ensured that companies from different size categories (see Figure 1) and industries (see Figure 2) were represented in sufficient numbers for statistical evaluation. The statements of the participants were weighted in the analysis to ensure that the results provide a representative picture of all German companies with at least 100 employees according to size category and industry.

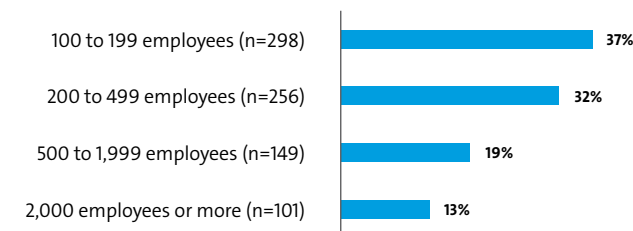


Figure 1 – Composition of the company sample by sample size (unweighted)

Sample: All surveyed companies with at least 100 employees (n=804)
Not all percentages add up to 100 as a result of rounding
Source: Bitkom Research 2019

This way, the sampling structure permits the presentation of peculiarities within selected industries. These include the automotive, banking, insurance, commerce, IT, telecommunication, transport, and logistics industry, whose sector-specific results are shown in ↗ Chapter 2.

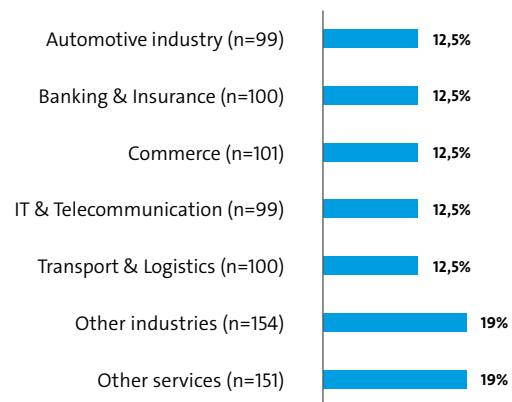


Figure 2 – Composition of the company sample by industry (unweighted)

Sample: All surveyed companies with at least 100 employees (n=804)
Not all percentages add up to 100 as a result of rounding
Source: Bitkom Research 2019

The interviews were conducted with executives responsible for open source software within their companies. The results showed that less than half (49 percent) of the companies designates this role formally or informally to a person. In 48 percent of the companies surveyed, there was a person informally responsible – for example, Head of IT or Digitalisation. Only one percent of German companies with at least 100 employees have created a formal position such as Head of Open Source.

In companies that had no designated person for open source software (51 percent), we surveyed their executives responsible for the implementation of software, e. g., software development. Figure 3 shows the composition of the sample according to the interviewed contact person.

We established a uniform understanding of what defines open source software for all participants at the beginning of the survey. It was the following description, which also underlies this research report:

»Open source software refers to software with a licencing agreement that permits the user to run it freely, analyse it, change it according to personal needs, and share it in modified or unmodified form. The prerequisite for this is that the source code is openly accessible and royalty-free.«

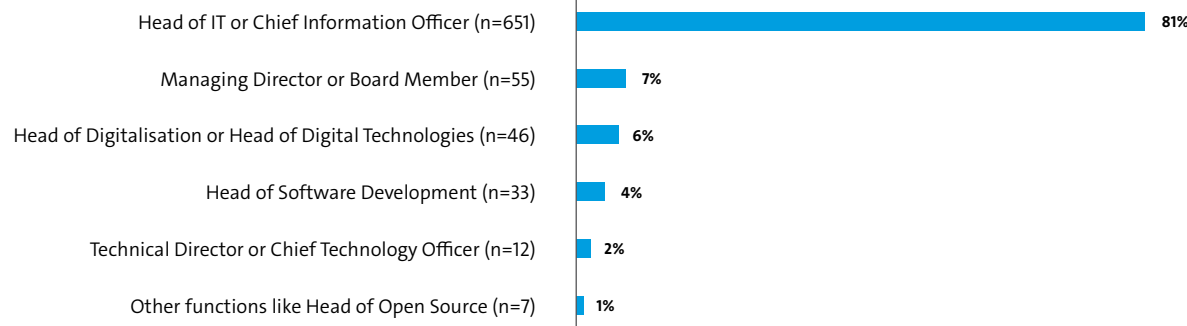


Figure 3 – Composition of the company sample by contact person

Sample: All surveyed companies with at least 100 employees (n=804) |
Not all percentages add up to 100 as a result of rounding
Source: Bitkom Research 2019



Expert statement

The Open Source Monitor 2019 highlights that a growing number of companies are relying on open source software (OSS). OSS has also come into widespread use in the enterprise environment. This trend is set to continue. There are a myriad reasons for this: shorter innovation cycles, reusability, and exceptional quality thanks to the applied four-eyes principle, to name just a few. However, the commercial use of OSS also requires systematic risk management, especially when it concerns licencing, security, and operational risks.

Licencing risks

First of all, you need to clarify with the legal department what open source licences are suitable for deployment in the company. Then you have to train the employees accordingly because the use of OSS is always tied to specific licencing conditions. For instance, copyleft licences¹ are problematic for some companies. Many companies or developers use commercial scanning tools such as Black Duck or WhiteSource to ensure licence compliance. However, there are also open source options available for that. SAP is involved in the Tooling-Group², which aims to create a fully open source toolchain for managing OSS (such as ClearlyDefined³, ORT⁴, SW 360⁵).

Licence security is not only crucial for in-house developments, but also throughout the entire software supply chain. Open-Chain is an initiative for this purpose that standardises best practices and facilitates certification.

Security risks

Open source security has been one of the core issues in deploying commercial IT solutions, and not just since unpatched software caused multi-billion-dollar damage, as in the case of Equifax⁶. Numerous companies – like SAP – rely on a mix of commercial and open source software tools. One example is the open source project Steady⁷, which was launched by SAP and recently taken over by the Eclipse Foundation to advance it with the community.

Operational risks

IT managers in the enterprise environment must ensure that open source-based solutions remain maintainable in the long-term but also operate failure-free. Companies should make sure when they select OSS components that the appropriate developer group can ensure sustainable development and maintenance.

Most projects managed by open source foundations can provide this assurance. Additionally, you should invest in the development of expertise or conclude commercial maintenance agreements for critical components.

Central coordination

In sum, we would recommend managing the opportunities and risks involved in using open source from one central location within the company. It is up to the individual company to decide whether the management of IT, the CIO or an open source Program Office (OSPO) assumes this role. Of crucial importance here is that you align the use of open source with the corporate strategy.

1 ↗ <https://www.gnu.org/licenses/copyleft.de.html>

2 ↗ <https://github.com/Open-Source-Compliance/Sharing-creates-value/wiki>

3 ↗ <https://docs.clearlydefined.io/>

4 ↗ <https://github.com/heremaps/oss-review-toolkit>

5 ↗ <https://projects.eclipse.org/projects/technology.sw360>

6 ↗ <https://www.heise.de/security/meldung/Megahack-Equifax-war-absolut-vermeidbar-4259677.html?seite=all>

7 ↗ <https://projects.eclipse.org/proposals/eclipse-steady>

1 Application of open source software in companies

1.1 Perception of open source software

Good news first: The majority of German companies with more than 100 employees displays a generally positive attitude towards open source software (see Figure 4). Three quarters of all companies (75 percent) are interested in open source software and are open towards the topic. Only four percent of the companies critically assess open source software and tend to reject it. In between these two positions, one fifth of the companies (19 percent) is undecided in regard to open source software.

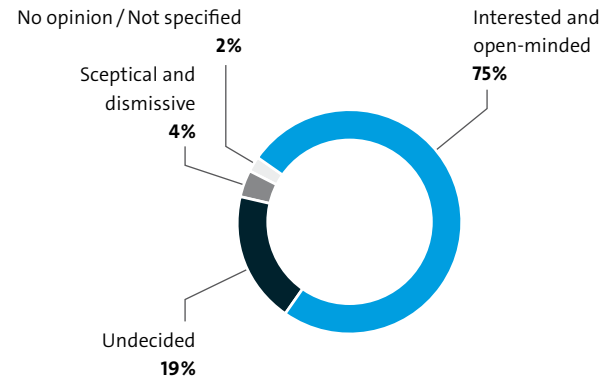


Figure 4 – Perception of open source software by company size
What is the general position of your company towards OSS?

Sample: All surveyed companies with at least 100 employees (n=804)

Source: Bitkom Research 2019

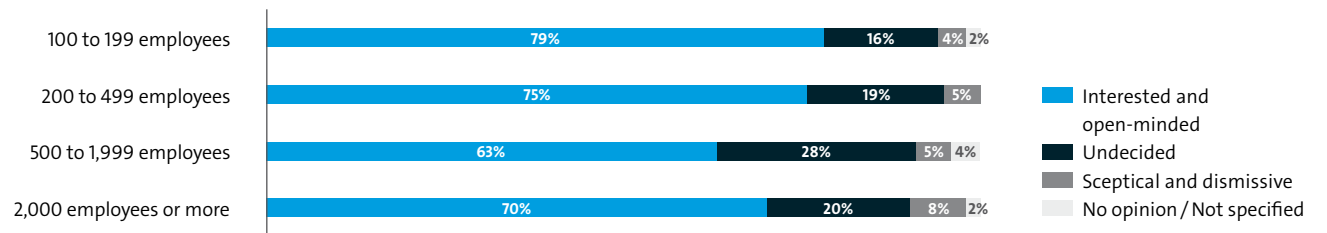


Figure 5 – Perception of open source software by company size

What is the general position of your company towards OSS?

Sample: All surveyed companies with at least 100 employees (n=804)

Not all percentages add up to 100 as a result of rounding | Source: Bitkom Research 2019

A glance at the company size reveals that the perception of OSS is not linear to the size of the company (see Figure 5). Small and medium-sized businesses show more interest in OSS than companies with 500 or more employees. Eight out of ten companies with 100 to 199 employees (79 percent) and three quarters of the companies with 200 to 499 employees (75 percent) are open-minded towards OSS. Only six out of ten large companies with 500 to 1,999 employees (63 percent) and seven out of ten companies that employ 2,000 or more people (70 percent) are open toward OSS.



PwC Case Study: OSS compliance for products and the organisation

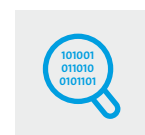
Challenge: Demonstrate OSS compliance

Like most companies, our client in this case study currently deals with the digitization of their existing products, as well as the creation of completely new digital solutions. In doing so, extensive use is made of open source software components.

One of their key customers (and subsequently the internal Legal & Compliance department) asked for proof of OSS licence compliance and requested a reliable, complete OSS Bill of Material (BoM) for their products.

At that time, our client was unable to provide a BoM on short notice and demonstrate that the relevant licensing obligations are fulfilled.

The reasons for this can range from a lack of awareness in the organisation to concrete process errors.



Scan source code for OSS and create reliable BoM



Establish OSS strategies and management systems



Build trust in products with OSS

Solution: Get compliant, stay compliant

In the first step, »Get Compliant«, our focus was on establishing the OSS compliance of the products, generating reliable BoMs including the necessary OSS compliance artifacts. For this purpose, information was gathered from the development teams, a code scan of the source code of the products was performed at snippet and component level. Then the scan results were analyzed, individual cases were clarified from an IT architecture and legal point of view, and the BoMs were generated.

In the second step, »Stay Compliant«, we focused on establishing OSS compliance of the organisation to continue to generate OSS licence compliant products. In particular, we developed an OSS strategy, guidelines and processes, defined responsibilities, a training concept and tailored tool support.

Advantages: Risk reduction and reliability

In this case, we have, for one thing, reliably established and demonstrated the necessary OSS compliance for the products at short notice and, for another, created structures to maintain OSS compliance in the future.

In addition, PwC offers a wide range of professional OSS management and compliance services, from software code scanning, to the development of OSS management systems and legal licensing advice, to OpenChain certifications to build trust in OSS in the supply chain.



Marcel Scholze,
Director Open Source
Software Services
PwC

»PwC« in this document refers to PricewaterhouseCoopers GmbH Wirtschaftsprüfungsgesellschaft, which is a member firm of PricewaterhouseCoopers International Limited (PwCIL).

The respective company is responsible for the content of the page.

1.2 Open source software strategy

Within the framework of the methodology we were already able to identify the first indications around the companies' strategic orientation concerning OSS. It shows that less than half of the German companies with at least 100 employees (49 percent) have created a position, in which the responsibility for OSS is formally or informally assigned. It was also found that one percent of companies in this group have created a formal position, for example Head of Open Source Software.

Based on the question of whether there is an OSS strategy present, the number of companies that approach the OSS topic strategically reduces significantly. Only every fifth company (21 percent) follows an OSS strategy and four out of five companies (77 percent) have no OSS strategy at all (see Figure 6).

Although large companies are less open to the topic of OSS, compared to small and medium-sized businesses (comparisons ↗ Chapter 1.1), they do approach the matter more strategically. Three out of ten large companies have developed an OSS strategy (27 percent between 500 and 1,999 employees; 31 percent with 2,000 or more employees). Within medium-sized businesses, there are about two in ten companies (19 percent between 100 and 199 employees; 21 percent with 200 to 499 employees).

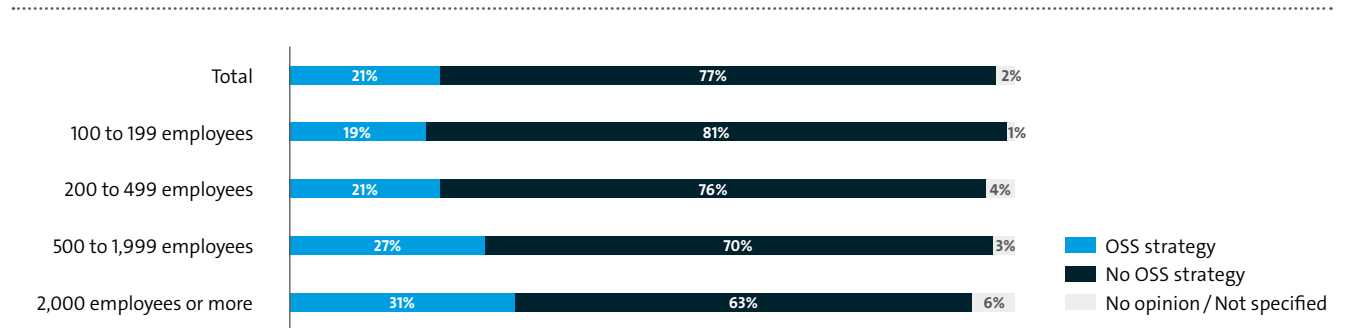


Figure 6 – Open source software strategy by company size

Does your company pursue an inter-departmental OSS strategy?

Sample: All surveyed companies with at least 100 employees (n=804) |

Not all percentages add up to 100 as a result of rounding | Source: Bitkom Research 2019

Not all strategies are equal, they vary in scope and content. Subsequently, companies that follow an OSS strategy (21 percent) can be divided as follows: most company strategies focus solely on using OSS (12 percent); the least amount of companies follow an approach that focuses exclusively on participating in OSS projects and communities (2 percent). Seven percent of the companies follow a strategy that consists of using OSS as well as participation (see Figure 7).

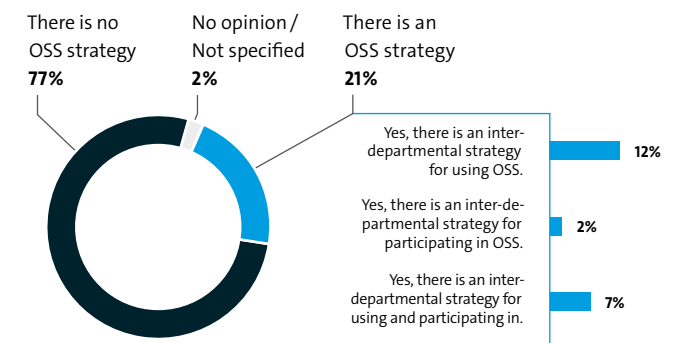


Figure 7 – Type of open source software strategy

Does your company follow a cross-divisional approach?

Sample: All surveyed companies with at least 100 employees (n=804)

Source: Bitkom Research 2019



Expert statement



Mario Ester
Director Public & Territory Sales Germany
SUSE

Internationally, German small-and-medium-sized businesses enjoy an outstanding reputation based on their precision, reliability, and quality work. It is these companies that rely on finding answers when it comes to facing a rapidly changing market, where competition and cost pressure is increasing continuously.

New technologies and developments like Mobile, Big Data, Augmented and Virtual Reality, or the Internet of Things (IoT), offer numerous solutions to expand the portfolio with disruptive business models, but also improve services, which secures long-term success.

This transformation works only if the underlying infrastructure is developed at the same time to provide the necessary agility for successful digitalisation. DevOps methods, in particular, help companies to be more agile and permit them to implement changes and react to new challenges swiftly. IT must not become an obstacle. However, IT in small-and-medium-sized businesses has grown significantly over the past decades, which challenges those responsible now for making it fit for the future.

Open source offers many the chance to link existing environments with innovative solutions. Modern technologies are often based on open source, which includes specialised tools like DevOps practices. These technologies are not tied to a single provider but are sustained and continuously advanced by many manufacturers, which makes them always up-to-date and futureproof. Hence, open source software is the basis and fuel for the successful digitalisation strategy of small-and-medium-sized businesses.

As the research report shows, those responsible in small-and-medium-sized businesses understand the potential and approach open source with an open mind. However, knowledge gaps concerning what role open source can play, how its implemented and used strategically, exist. One cause is the lack of experience working with open source but also the fact that new open source projects, in particular, are not designed to work with legacy IT systems.

That is why a step-by-step approach is recommended for a successfully designed digital change. In cases where no experience with the open source world exists, small projects, in particular, help to provide an entry point and alleviate reservations. If necessary, these can be easily scaled on demand, which reduces financial risk and unprofitable investment. It also helps to rely on the support of providers with a robust ecosystem of numerous manufacturers. These providers can develop and amend tailor-made software solutions that meet the requirements of small-and-medium-sized businesses but also provide long-term consultation and support.

This approach permits companies to combine tradition with innovation, tackle the complexity of migrating their IT landscape with the help of experts, and entrench open source within their IT strategy.

1.3 Application of open source software

The majority of German companies with at least 100 employees are generally interested and open towards open source software (cf. ↗ Chapter 1.1). The strategic integration of the topic in corporate practice has somewhat put this first positive picture into perspective (cf. ↗ Chapter 1.2). What about the actual use of OSS in companies? This section is intended to focus on the use of OSS and, at the same time, provide answers to the following questions:

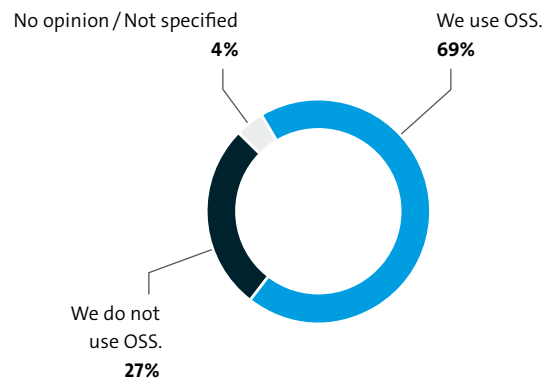


Figure 8 – Application of open source software
Which of the following statements apply to the use of OSS within your company?

Sample: All surveyed companies with at least 100 employees (n=804)
Source: Bitkom Research 2019

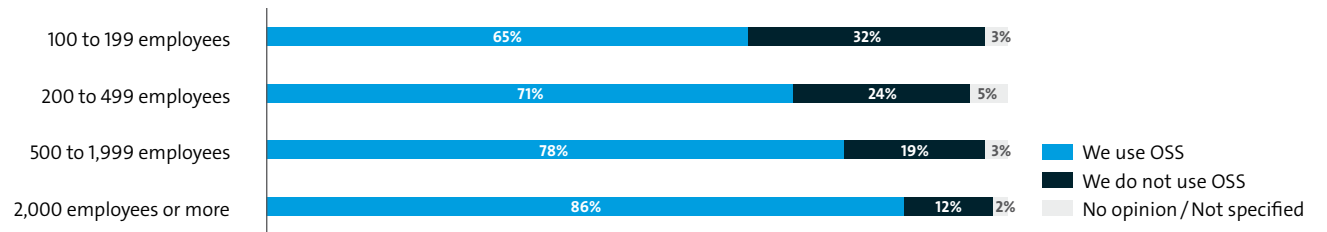


Figure 9 – Application of open source software by company size
Which of the following statements apply to the use of OSS within your company?

Sample: All surveyed companies with at least 100 employees (n=804)
Source: Bitkom Research 2019

- To what extent does your company use OSS?
- What role does OSS play in connection to digital technologies such as artificial intelligence?
- How do companies deal with problems associated with OSS?
- What drives the topic of OSS in companies?

Seven out of ten companies with at least 100 employees (69 percent) state that they consciously use OSS within their company (see Figure 8). This contrasts with a quarter of the companies (27 percent), who state that they don't use OSS solutions at all.

Companies with up to 199 employees showed the most interest in OSS. Accordingly, these companies show the most significant potential for development in actual company use. After all, two thirds (65 percent) of these companies use OSS already. Larger companies, however, tend to use OSS solutions more often. Seven out of ten companies in the size category 200 to 499 employees (71 percent) use OSS, three quarters of companies in the category 500 to 1,999 employees (78 percent), and as much as 86 percent of companies with 2,000 or more employees (see Figure 9).

The most common application for OSS within companies is based on solutions catering to a specific internal user group, without amending the source code (see Figure 10). More than half of the German companies with at least 100 employees (58 percent) utilise OSS this way. A third of the companies (32 percent) use OSS applications within their company while making changes to the source code. A fifth of the surveyed companies uses OSS within their products or services, which they pass on to the customers with (20 percent) or without (22 percent) amended source code. The development of independent OSS products or solutions is the core business of only two percent of the companies.

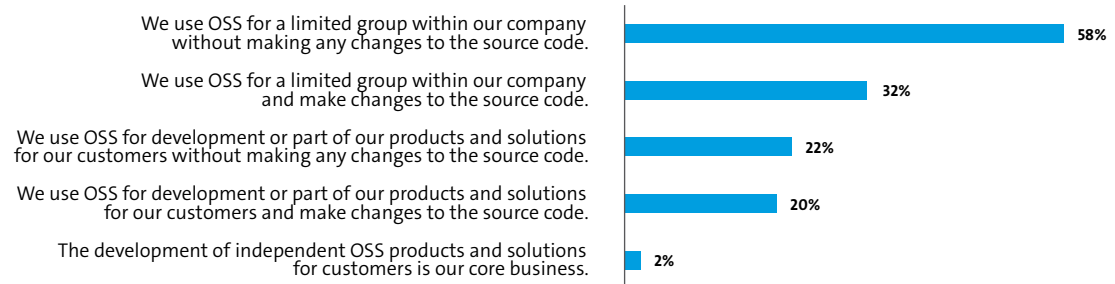


Figure 10 – Application of open source software by type

Which of the following statements apply to the use of OSS within your company?

Sample: All surveyed companies with at least 100 employees (n=804)
Multiple answers possible | Source: Bitkom Research 2019

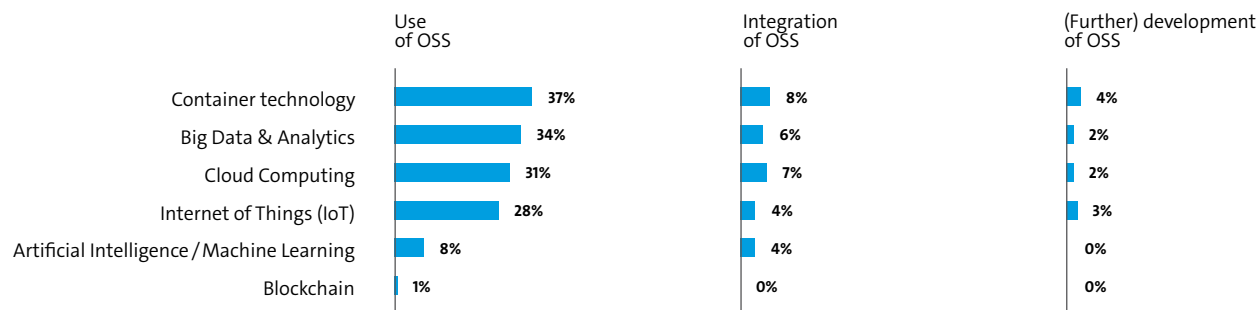


Figure 11 – Application of open source software in conjunction with emerging technologies

In which of the following areas do you integrate or develop OSS?

Sample: Companies with at least 100 employees that use, integrate, (further) develop or participate in OSS projects / communities (n=570)

Multiple answers possible | Source: Bitkom Research 2019

The possible uses for OSS extend across nearly all IT application areas. For this reason, the Open Source Monitor 2019 researches new areas of application such as cloud computing, Internet of Things (IoT), or in particular, Artificial Intelligence (see Figure 11).

It shows that OSS is already a decisive factor in new technologies. Around a third of all companies that use OSS utilise it in connection with container technology (37 percent), Big Data & Analytics (34 percent) or cloud computing (31 percent).

Use of OSS in this context means that companies use software internally without making any changes to the source code. Concerning these three technologies, another six to eight percent integrate OSS into their products or solutions without making any source code changes, and two to four percent use development resources in these areas.

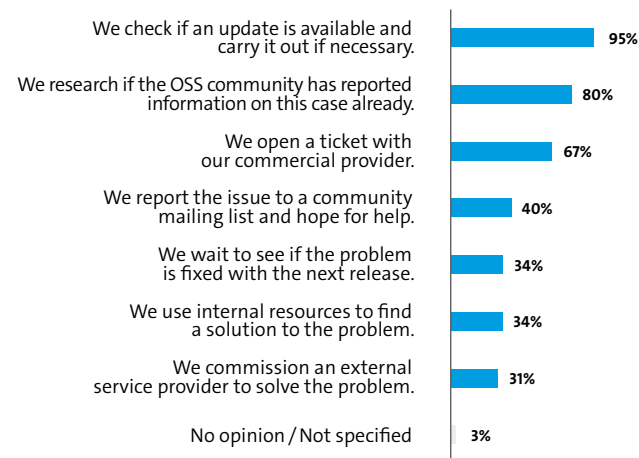


Figure 12 – Addressing open source software issues
 How does your company deal with missing features in the code or if the open source code isn't working as expected?

Sample: Companies with at least 100 employees that use, integrate or (further) develop OSS (n=558) | Multiple answers possible | Source: Bitkom Research 2019

Which is followed by the use of OSS within the context of the Internet of Thing (IoT). A quarter of the companies that engage with OSS use it already. Another five percent integrate and three percent develop OSS. Artificial Intelligence and blockchain follow somewhat behind, which reflects the use of these technologies within the German economy. Only eight percent of the companies that work with OSS use it in connection with Artificial Intelligence, for blockchain it is merely one percent. For the majority of the companies, OSS is not a topic at all (84 percent and 95 percent).

The solutions by companies vary in cases where the respective open source software causes problems, for example, not working as expected, or missing an OSS feature for a specific application (see Figure 12).

Almost all companies (95 percent) that use, integrate or (further) develop OSS check if an existing update resolves encountered problems. Eight out of ten OSS users (80 percent) research relevant forums and communities for solutions, while four out of ten (40 percent) report the problem to the same and ask the community for support. Two thirds (67 percent) open a ticket with their commercial OSS provider. Around a third utilise development resources of their own to fix a problem (34 percent) or hire an external OSS service provider to do so (31 percent). Another third (34 percent) waits initially on a new OSS release, which eliminates existing issues.

In companies that use OSS, operational units tend to drive its use (see Figure 13). In the majority of companies, it is individual departments that take responsibility for OSS (58 percent). In nearly a third of all companies (30 percent), it is individual employees that push the use of OSS within the company. In only every twentieth company (5 percent) the topic is brought into the company by the management level or even externally, for example by service providers (5 percent) or business partners (1 percent).

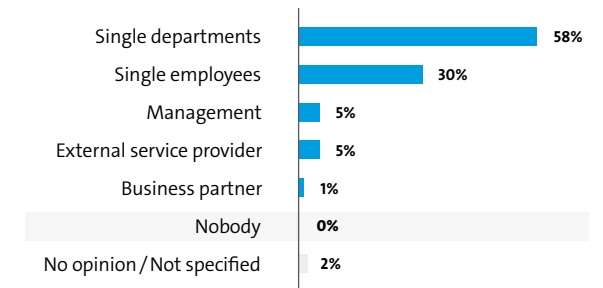


Figure 13 – Driver factors of open source software in companies
 Who pushes the topic of OSS within your company?

Sample: Companies with at least 100 employees that use, integrate, (further) develop or participate in OSS projects / communities (n=570) Not all percentages add up to 100 as a result of rounding Source: Bitkom Research 2019



Expert statement



Boris Cipot, Senior Security Engineer Synopsys Software Integrity Group

Times change and as a result demand more attention – this is particularly applicable to the area of open source software. Complexity is prevalent in the technology industry, especially if security plays a significant role.

The use of open source is already widespread and continues to increase. Compared to last year, the number of companies that use OSS has grown significantly. However, we also see that there are very few software-development projects that

do not use open source software, except for specialised industries like automotive transmission systems or similar. In Germany, 69 percent of the surveyed companies use OSS, and the trend is increasing steadily. According to the global Open Source Security and Risk Analysis (OSSRA) Report from 2019, 60 percent of the surveyed companies used open source in the analysed code in 2018. An increase of 3 percent over the previous year. However, feedback from companies is divided when it comes to the use and advantages of open source software. Most companies use existing open source components and utilise them for their applications without amending them. A third of the surveyed companies, however, changes or expands the source code to ensure it is better suited for the desired functionality. The use of OSS provides advantages in both cases, for example, faster development times or greater competitiveness on the market. However, the advantages can only be leveraged as long as companies adhere to maintain, update and respect the licensing rights of open source code used in their software. This way, the use of open source is not a problem.

Nonetheless, the report shows that several companies do not use open source software intentionally or because they lack an OSS strategy, the necessary personnel, or training opportunities, which can make the use of open source components a potentially expensive and risky venture.

The introduction of security and processes for reviewing licencing rights is inevitable, especially for open source components in applications for customer products and solutions. In doing so, you ensure that you have a clear overview and control over the used open source components to meet requirements and better tackle problems.

My advice: Take on the challenge! The following steps will prove useful in ensuring success and making the best possible use of open source:

1. If you are using open source software, plan and be alert, it is impossible to maintain OSS if you do not know how to use it.
2. Make sure to identify and remove untrusted source code or OSS early in the development cycle and keep a close eye on the rest of the process. It permits you to identify and fix new problems swiftly.
3. Develop processes that allow you to react and fix issues at an early stage.
4. Security should be a critical part of your DevOps culture.
5. Integrate security into each step of the development process.

Feel free to contact me directly anytime in case of questions.
[↗bcipot@synopsys.com](mailto:bcipot@synopsys.com) | [↗@boris_cipot](#) | [↗LinkedIn](#)

1.4 Participation in open source software development

Open source software thrives on active user participation in its development. An active OSS community, which collaborates on the projects, is the basis for a successful OSS project. Nearly every third company with at least 100 employees (31 percent) actively participates in the development of OSS or permits their employees to do so (see Figure 14).

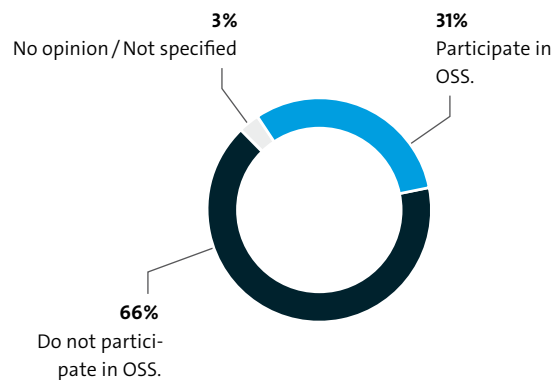


Figure 14 – Participation in open source software development
Does your company participate in the development of OSS?

Sample: All surveyed companies with at least 100 employees (n=804)
Source: Bitkom Research 2019

Participation of companies in OSS projects is structured as follows (see Figure 15): More than half of the companies that support OSS (55 percent) allow individual employees or teams to participate in OSS projects as part of their work. Four out of ten (39 percent) support OSS projects as a paying member or sponsor of OSS initiatives. A quarter of the OSS supporters initiates or supports OSS projects of their own (24 percent) through their business activity. The least amount of companies provides changed OSS source code back to the community (15 percent).

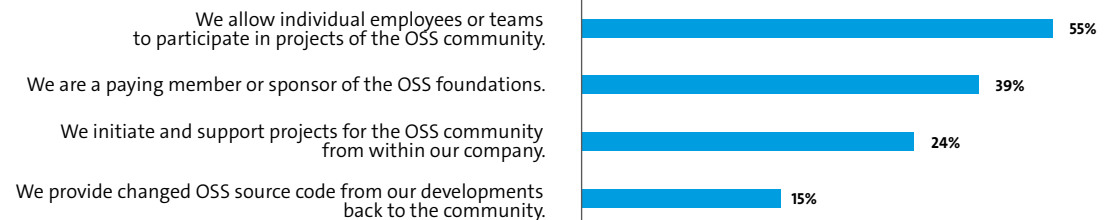


Figure 15 – Extent of participation in OSS development
To what extent does your company participate in the development of OSS?

Sample: Companies with at least 100 employees that participate in OSS (n=248) | Multiple answers possible
Source: Bitkom Research 2019

Companies are involved in OSS projects for various reasons (see Figure 16). The majority of OSS supporters state that, amongst other things, the economic aspect plays an important role. Eighty-six percent of companies participate in OSS with the aim of reducing costs. For around a third of the companies, participating in OSS projects is part of their overarching corporate identity. Companies consider their participation part of their general OSS understanding (67 percent), the company's corporate identity (63 percent), or as their contribution to the Shared Economy (62 percent), in which all parties benefit from sharing knowledge and resources. An additional third of OSS supporters (31 percent) have integrated their OSS participation into their company's innovation strategy.

Every second company participating in OSS projects and the community anticipates to remain up to date on latest trends and topics (54 percent) or to tutor their employees on OSS (47 percent). A nearly identical proportion (48 percent) also sees the participation as an integral aspect in motivating their employees. For potential job candidates, participation in OSS projects can be a determining criteria. That is why eight percent of the companies see their OSS support also as an essential aspect when hiring new employees.

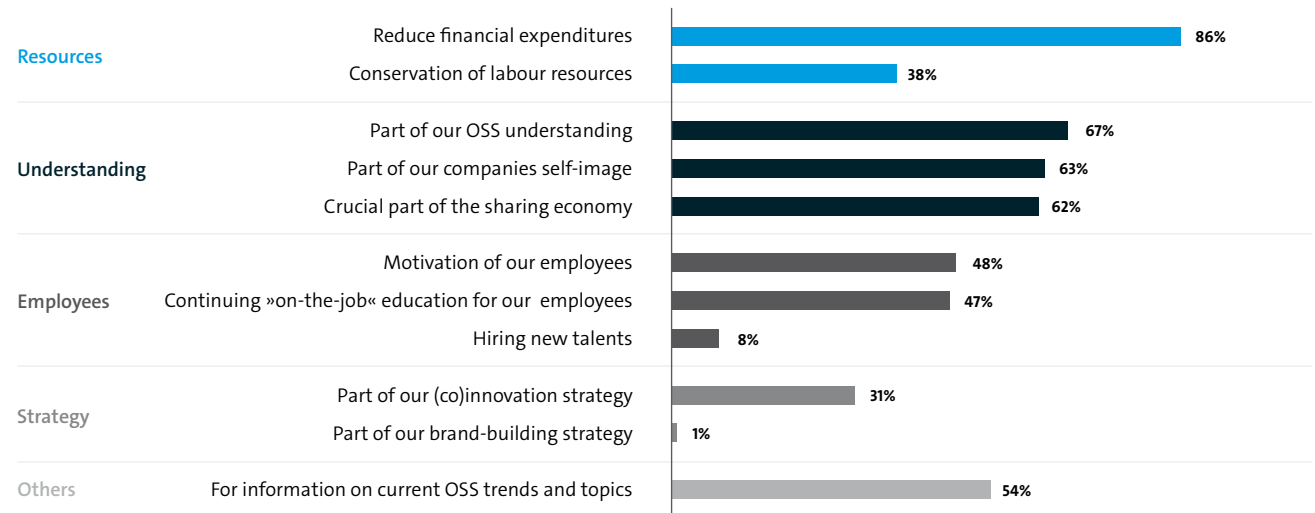


Figure 16 – Reasons for participating in open source software development

What motivates your company to contribute to the development or further development of OSS?

Sample: Companies with at least 100 employees that participate in OSS (n=248) | Multiple answers possible
Source: Bitkom Research 2019

Expert statement



Prof Dr Christian
Czychowski
Rechtsanwalt,
NORDEMANN

As the present report shows, the use of open source software can offer numerous advantages. Nearly 70 percent of the companies with 100 employees or more use open source components. The reasons range from cost savings on licensing fees over independence from proprietary providers to enjoying those advantages that an active open source community brings. However, the use of open source software increases the demands towards legal compliance when using these components.



Dr Jakob Valvoda
Patentanwalt,
BOEHMERT &
BOEHMERT

Ensuring legally compliant use of open source software can be multi-layered and complex. In particular, in the case of onwards sale of products that contain open source components, the licensing conditions for each element must be fulfilled. During consultations, we often witnessed that companies were lacking a (reliable) overview about the included open source components and their corresponding licensing conditions.

This is aggravated by the fact that many licensing texts are neither easy to understand nor concise, which leads to questions that, to a great extent, have judicially not been solved. Should licensing conditions for the onwards sale of components not be met, copyright claims against the distributor arise, which can range from imposing a ban on further sales, indemnification to product recall. Generally, the open source community tends to pursue this kind of claims reluctantly. On occasion, individual developers have made this their business model, for which they receive sharp criticism from some in the open source community. In any case, key accounts increasingly demand the respective compliance as part of their supplier requirements framework. Because the buyer, once redistributed, is also liable for the software sold to him by the supplier.

These requirements can be met with an active open source policy. Well-structured processes and defined responsibilities can create the necessary transparency concerning the software used, help to verify the respective licence, and ensure that use conditions are met. At the same time, meeting open source requirements concerning own intellectual property and compatibility with proprietary third-party components should also be considered.

Many of these processes can be standardised, replicated, and scaled within the organisation once introduced. At any rate, specific criteria should serve as the basis for each release to ensure that no copyrights are violated. Establishing and using a sound open source policy will help to mitigate administrative expenses, but also potential risks of using open source software and permit to utilise the many advantages that the use of open source brings.

1.5 Advantages and disadvantages of open source software

Advantages

The predominantly positive attitude of companies towards OSS continues when asked about OSS advantages. Nine out of ten (88 percent) of companies with at least 100 employees acknowledge advantages in using OSS for their company (see Figure 17). Only every eleventh company (9 percent) claim no advantage in using OSS. All companies that use, integrate, (further) develop or participate in OSS in any other way, stated that there are advantages in using OSS; a third (34 percent) of the companies that do not engage with OSS didn't recognise any gains in using OSS.

The most commonly cited advantage of OSS is cost savings since no licensing fees are usually involved. It was stated to be a significant advantage for companies accumulating to 17 percent. Several other reasons were mentioned, which only differ by a few percentage points. It is crucial to pay attention that the question of OSS advantages was open-ended and posed in a way that permitted the surveyed companies to concentrate on the most significant advantage for their company.

Given the above, the following results illustrate that many arguments speak in favour of using OSS from the companies' point of view and that the cost analysis is just one of many aspects.

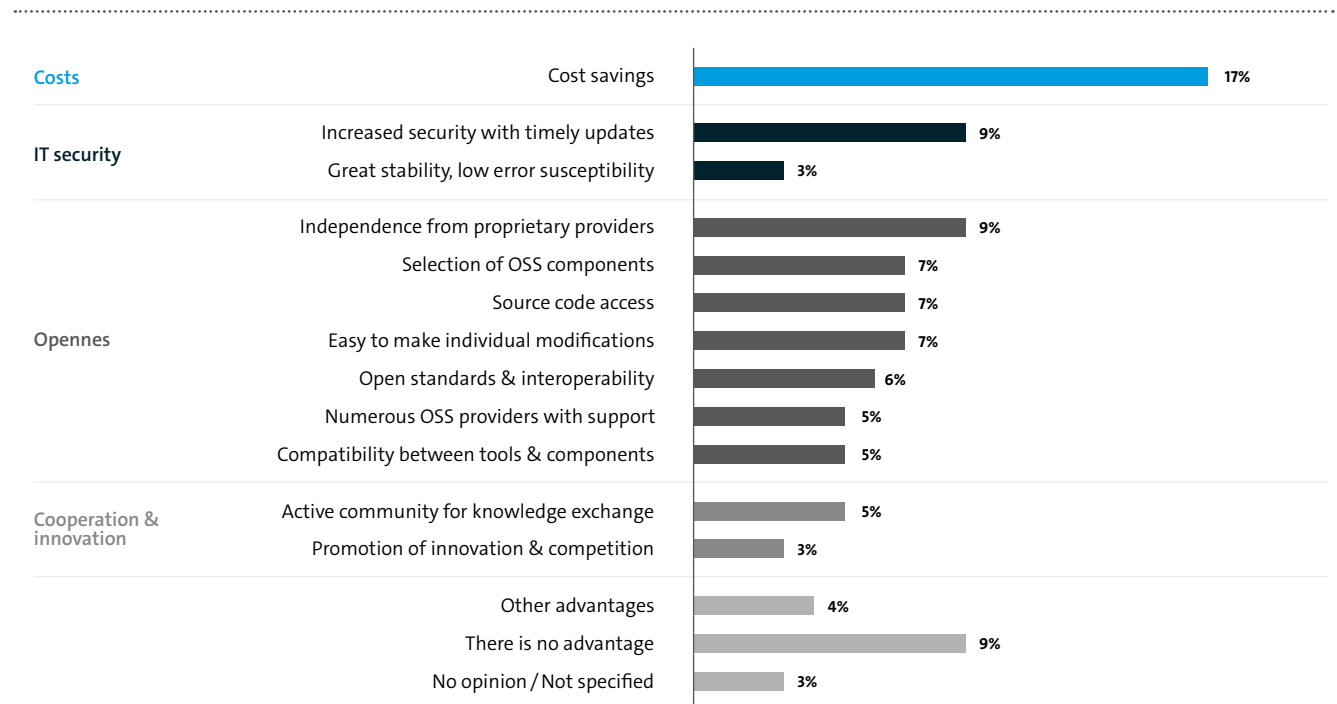


Figure 17 – Advantages of open source software

In your opinion, what is the most significant advantage in using OSS in your company?

Sample: All surveyed companies with at least 100 employees (n=804) | Source: Bitkom Research 2019

Twelve percent of companies overall state security-related advantages. Every eleventh company (9 percent) appreciates the robust security through regular and timely updates. Another three percent welcomes the stability and low error susceptibility of OSS.

Additionally, the openness and flexibility OSS provides are decisive factors in many respects. One of eleven companies (9 percent) rated independence from proprietary software providers as advantageous, respectively seven percent name the selection of open source components, access to the source

code, or the uncomplicated implementation of individual software modifications as advantageous. Every twentieth company states the support of open standards and interoperability (6 percent), the diverse selection of OSS providers (5 percent), or the compatibility between tools and components (5 percent) as the main advantage of OSS. Another eight percent see the knowledge exchange with the community (5 percent) as well as the promotion of innovation and competition (3 percent) as advantages of using OSS.

Disadvantages

From the companies' point of view, various disadvantages offset the advantages. They can be categorised as follows: personnel, uncertainty, IT security, and supply (see Figure 18). Respondents were asked to state the disadvantages as openly as advantages.

Twelve percent state the lack of skilled labour as the most significant disadvantage, meaning experts in the company, who can adapt the software to individual requirements and develop it further. In this connection, they also consider a lack of training opportunities (6 percent) and substantial investments for the training and induction (5 percent) of the relevant specialists a disadvantage.

The results on the subject of IT security, show how ambivalent the companies are towards the use of OSS. While twelve percent consider security-related aspects as advantages of OSS, seven percent tend to see them as disadvantages.

Four percent cite security gaps as a disadvantage of OSS, and another three percent criticise the error susceptibility.

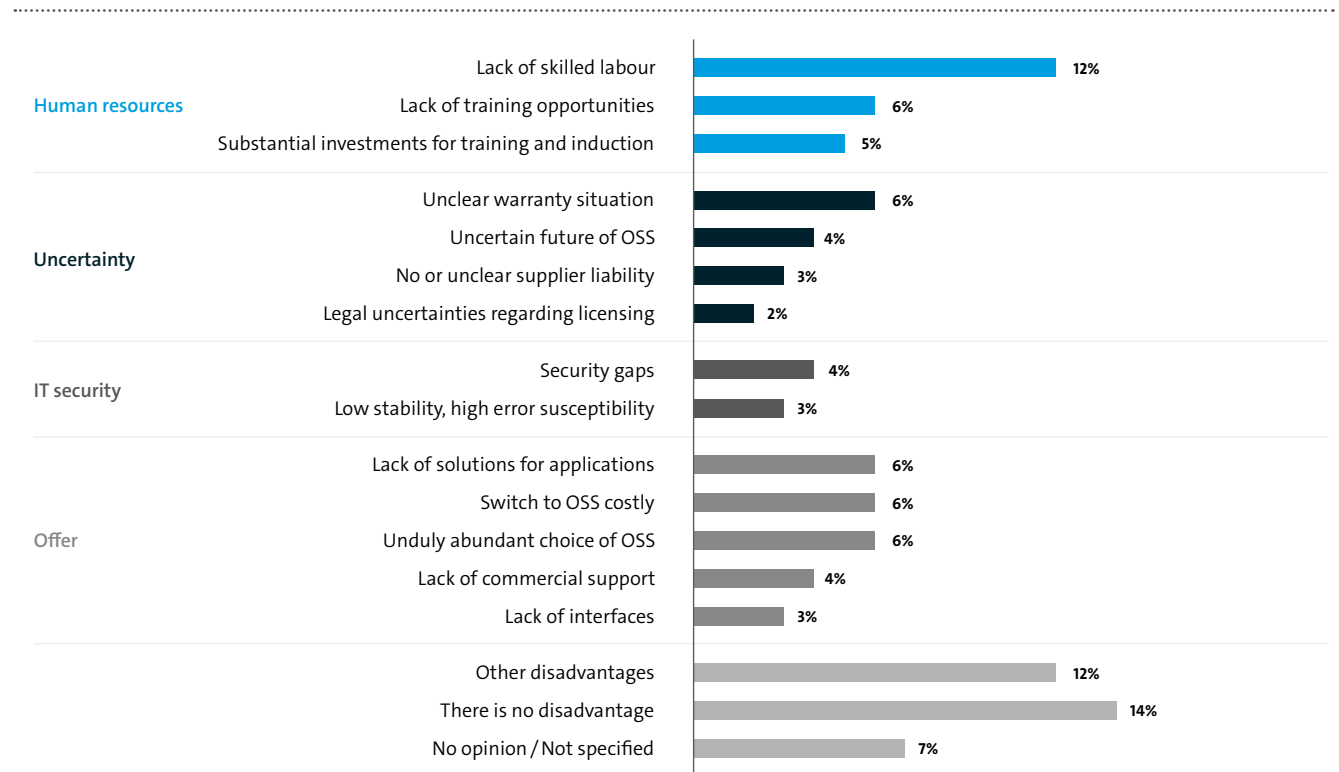


Figure 18 – Disadvantages of open source software

In your opinion, what is the most significant disadvantage preventing the use of OSS in your company?

Sample: All surveyed companies with at least 100 employees (n=804) | Source: Bitkom Research 2019

The ambivalent discussion on OSS continues in the category supply. Not all companies regard the vast selection of OSS components and providers as an advantage. Six percent rate it as a disadvantage. An additional six percent criticise the lack of OSS solutions for their applications or rate the switch from the deployed proprietary software to OSS or the establishment of an OSS-oriented development as extremely costly.

The application and use of OSS entail various uncertainties for some companies. Six percent express uncertainty about the warranty situation of OSS and three percent about the supplier liability. An additional two percent cite legal uncertainties regarding the licensing.

Overall, eight out of ten companies (79 percent) named a disadvantage of OSS. In contrast, 14 percent of all companies with at least 100 employees see no compelling disadvantage against the use of OSS in their company. If we compare those companies that use, integrate, develop or participate in OSS in other ways with those that do not use OSS, a similar picture emerges as with the advantages. Every fifth OSS user (19 percent) recognises no disadvantage whatsoever in using OSS, while no company in the non-user group states that.



Expert statement



Karsten Stöhr
Data Architect, DataStax

The present study shows clearly that there is considerable support for open source software in the German economy. The advantages of OSS therefore seem to be known regardless of the industry.

OSS solutions support open standards, offer independence from the provider, ensure compatibility with other tools used, and can be customised according to personal preferences.

However, there is still some confusion. Chiefly, seven percent of respondents still have concerns about IT security when using OSS. However, these worries are unfounded: Neither open nor closed source can provide a comprehensive guarantee against attacks. Nevertheless, OSS offers transparency: open source code allows a broad community of practical experts to work continuously on optimisation and further development. Consequently, security gaps are usually closed swiftly. The processes of manufacturers of proprietary software are more challenging to understand. Patches are often only offered every month, and even professional developers cannot modify the code.

Contrariwise, it is understandable that the ambiguous warranty situation acts as a barrier. OSS does not come with guarantees or traditional support. The community bears all the responsibility instead. These factors also result in significant dependency: since the demand alone decides whether the particular project will be advanced.

The shortage of skilled labour, the most significant disadvantage of using OSS according to the study, poses a genuine problem as well. If your company lacks the knowledge, those responsible can fall back on commercial open source offers, for instance. These offer professional support, advice and complementary solutions for administration and operation – just as users of commercial software are accustomed to. At the same time, businesses continue to benefit from the high development pace of OSS and increase acceptance in the company through additional security standards and compliance with Support Service Level Agreements (SLAs).

Commercial open source offers combine the best of two worlds: They permit the advantages of OSS to be put to best use without consuming excessive time and resources or having to develop internal expertise. Accordingly, they strike the perfect balance between open source and proprietary software.

In the future, companies should, therefore, approach the issue of OSS more strategically and not be deterred too quickly by the perceived disadvantages. Only this way can they utilise the full potential of OSS.

1.6 Open source software compliance

Open source refers to software the user can run freely, containing source code the user can inspect, change and share in modified or unmodified form. However, open source software does not come without obligations. In some instances, the use of OSS is subject to specific obligations or conditions that are indicated in the licence. Failure to comply with the licensing conditions can lead to warnings and the assertion of injunctive relief or claims for damages, which can get very costly for companies.

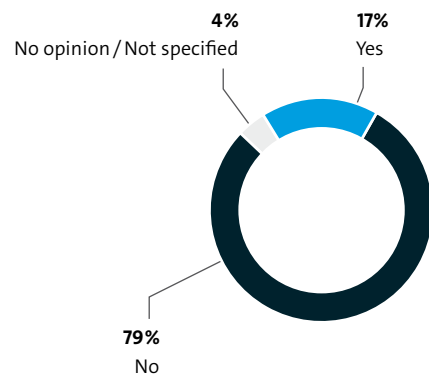


Figure 19 – Open source software policy
Does your company have an OSS policy, for instance a document in which guidelines and rules concerning the use of OSS within your company are recorded?

Sample: Companies with at least 100 employees that use, integrate, (further) develop or participate in OSS projects / communities (n=570)
Source: Bitkom Research 2019

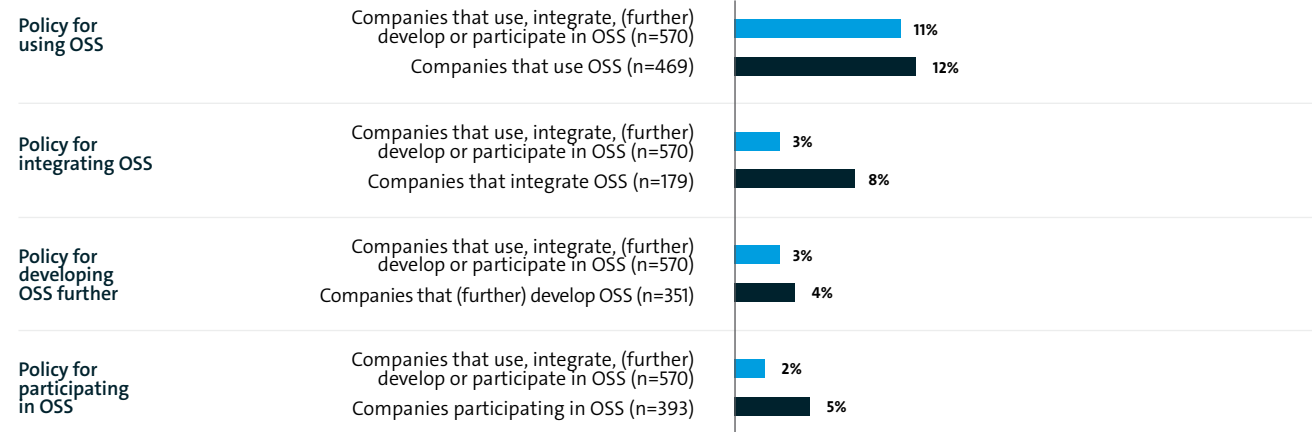


Figure 20 – Open source software policy by topic
Does your company have an OSS policy, i.e., a document in which guidelines and rules concerning the use of OSS within your company are recorded?

Sample: Companies with at least 100 employees that ... (n=see figure) | Multiple answers possible | Source: Bitkom Research 2019

To prevent this from happening in the first place, companies that rely on OSS should also employ appropriate OSS compliance management. In doing so, the first building block of compliance can be an OSS policy. The term policy refers to a written document that contains guidelines and rules for using OSS in the company. A corresponding OSS policy should be part of the required reading of those employees who work with OSS.

However, companies that use OSS, integrate it into their products and solutions, develop or participate in OSS projects and communities, appear to have a lot of catching-up to do. Only about every sixth company (17 percent) that uses OSS has an OSS policy. The majority (79 percent) of OSS users have not defined any policies (see Figure 19).

A closer look at content of the defined OSS guidelines illustrates that exact point (see Figure 20). The requirements for the OSS policy vary depending on whether a company only uses OSS, integrates OSS, (further) develops it or participates in OSS projects. However, the survey shows no significant differences between companies that use OSS and all the companies that deal with OSS in any way. Twelve percent of these companies, respectively, have a policy for the application of OSS. The same applies to the development of OSS. We only see a different picture in the areas of integration and participation, although this does not change the general need for companies to catch up.

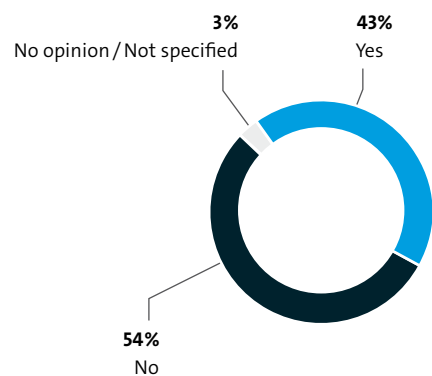


Figure 21 – Open source software compliance process
 Has your company recorded a compliance process, which is defined as a standardised procedure for dealing with OSS?
 Sample: Companies with at least 100 employees that use, integrate, (further) develop or participate in OSS projects / communities (n=570)
 Source: Bitkom Research 2019

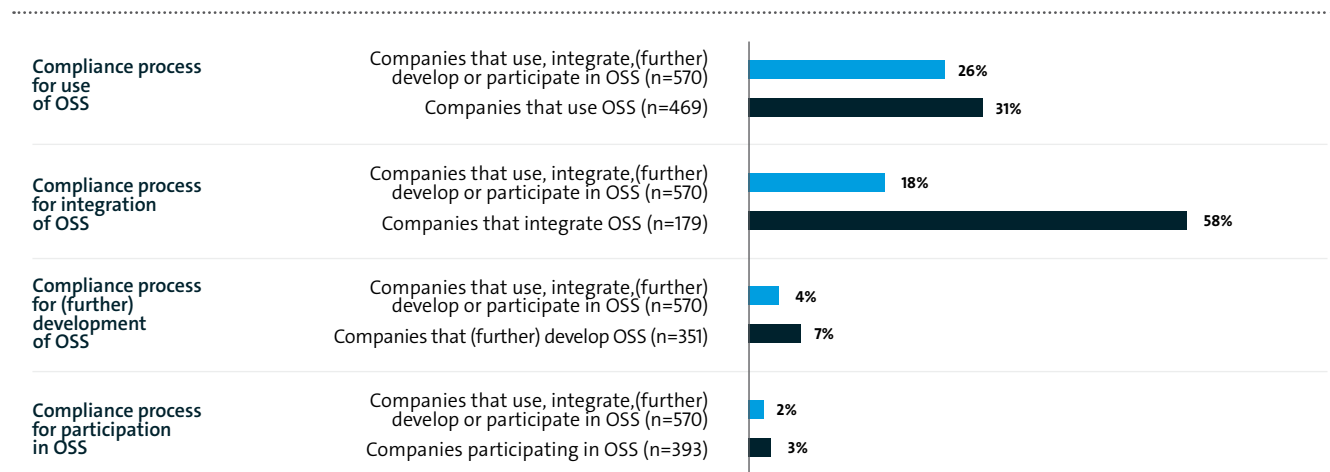


Figure 22 – Open source software compliance process by topic
 Has your company recorded a compliance process reflecting a standardised procedure for dealing with OSS?

Sample: Companies with at least 100 employees that ... (n=see figure) | Multiple answers possible
 Source: Bitkom Research 2019

The results on the existence of compliance processes within the company are slightly different (see Figure 21). Compared to the OSS policy, the percentage is more than twice as large. Four out of ten companies (43 percent) that use, integrate, develop or participate in OSS have compliance processes that are well-defined and recorded.

More specifically, those companies that integrate OSS into products and solutions for their customers are particularly sensitive to the issue of OSS compliance (see Figure 22). Six out of ten of these companies (58 percent) have implemented a compliance process, whereas the figure for companies that deal with OSS drops to only around two out of ten (18 percent).

Based on the present research results, one can only speculate why the issue of OSS compliance plays a rather subordinate role in many companies.

A majority of companies appear to be deterred by the complexity of the topic. For instance, seven out of ten companies (71 percent) that deal with OSS state that it is virtually impossible to achieve full OSS compliance.

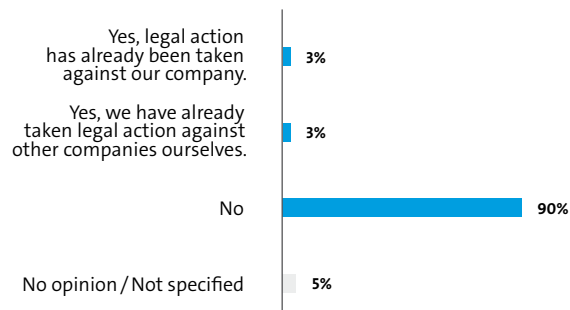


Figure 23 – Legal action in connection with open source software

Has anyone ever taken legal action against your company in connection with OSS or have you ever taken legal action against other companies or individuals?

Sample: All surveyed companies with at least 100 employees (n=804)

Multiple answers possible

Source: Bitkom Research 2019

The costs of OSS compliance do not play a significant role for most companies. Only one in four companies (27 percent) rate the costs as inappropriately high. In this respect, it is worth keeping in mind that OSS compliance costs are generally disproportionate to the costs that companies may face in the event of potential licence violations.

Three percent of all companies with at least 100 employees for each response, have already taken legal action in connection with OSS, against other companies or individuals or were themselves affected by legal action against their company (see Figure 23). The companies that were subject to legal action against their company were faced with the following facts (see Figure 24): Seventy-one percent received a notice from an OSS copyright holder that proved unsuccessful. A notice was only successful in one percent of cases. Nineteen percent have fought off action, and four percent have successfully sued an OSS copyright holder. None of the companies concerned has signed a cease-and-desist declaration.

However, it cannot be ruled out that the number of unreported successful legal actions against companies is higher. Not only is this supported by the unusually high number of 19 percent who did not answer this question, but also the common practice of agreeing on maintaining confidentiality in the course of legal disputes.

Moreover, it is common practice to agree on maintaining confidentiality in the course of legal disputes.

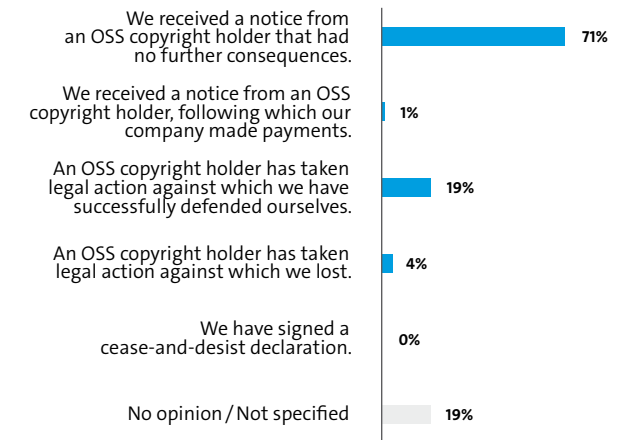


Figure 24 – Success and failure of legal actions against companies in connection with open source software
Which of the following statements apply to the legal actions taken against your company in connection with OSS?

Sample: Companies with at least 100 employees that were previously subject to legal action in connection with OSS (n=27)

Multiple answers possible | Source: Bitkom Research 2019

Almost every second company (46 percent) which uses, integrates, develops or participates in OSS relies on external partners, such as specialised law firms, for legal advice on open source software. Every fourth company (28 percent) has access to the internal legal department, and every tenth company (10 percent) handles the issue at management or board level. In contrast, 15 percent of companies have not established responsibility (see Figure 25).

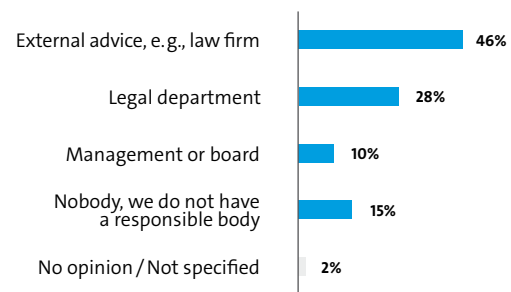


Figure 25 – Liability for open source software in companies

Who is responsible for legal advice on OSS in your company?

Sample: Companies with at least 100 employees, which use, integrate, (further) develop or participate in OSS projects or communities (n=570)

Not all percentages add up to 100 as a result of rounding

Source: Bitkom Research 2019



Expert statement



Dr Hendrik Schöttle
Lawyer, partner, specialist lawyer for IT law
Osborne Clarke

The study confirms what we frequently observe in practice: While many companies use OSS, they lack a policy or a compliance process – thus accepting a high risk of compliance violations.

However, the case is clear from a legal perspective: The law requires companies to counteract developments that threaten their existence early on by setting up monitoring systems, i.e. they must take appropriate compliance measures.

Indeed, every company that uses OSS is subject to contractual obligations that it must fulfil. The conditions in the licences of many OSS components stipulate sanctions for infringements. Additionally, there are also statutory claims for injunctive relief and damages, which do not require specific regulation in OSS licences. Thus, many companies are not aware of them.

Anyone who has assisted companies in the defence against claims for OSS licence violations knows that in such a case mostly the entire product portfolio has to be reviewed and must be cleaned up for compliance violations. And since there are, in principle, no implementation deadlines for remedying infringements, this is necessary immediately.

In other words: In such a case, the introduction of compliance measures is inevitably placed on the agenda of the company, accompanied by significant time pressure.

The implementation cost in such a case is significantly higher compared to a planned introduction of compliance measures without time pressure.

There is no standard process that is equally suitable for every company, but there are solutions that save you from having to start the test all over again every time. In our practice, we regularly develop tailor-made solutions for the needs of our clients - from manual checking and processing of individual packages of smaller software stacks to fully automatic scanning as an integral part of the development toolchain.

For the legal evaluation of licence obligations, we have developed a legal-tech solution that makes the soft factor of law measurable, automatable and auditable: through a standardized, legal classification and evaluation of proprietary and OSS licences and components, legally secure and fully documented. This ensures that the legal licence check can be integrated into the compliance process in a scalable and automated manner and that the bottleneck does not necessarily have to be, even with more complex legal questions.

2 Industry specific trends

The first chapters provided a representative overview of the extent to which companies in Germany with at least 100 employees are using OSS. The following chapter will examine to what extent selected industries are using OSS. The project consortium decided to review the following five sectors more indepth. The industry-specific results of which we will compare to the overall results: the automotive industry, financial and insurance sectors, commercial, IT and telecommunication (ICT), as well as the transport and logistics industry.

The positive attitude of companies towards OSS is at a high level across all industries. The figures fluctuate only minimally for each industry, a total of 75 percent are interested in OSS and open-minded (see Figure 26). Transport and logistics companies, on the other hand, show the least interest. Seven out of ten companies in this industry (71 percent) display open-mindedness about OSS. Commercial undertakings are on the other end of the spectrum, with eight out of ten companies (80 percent) showing interest and openness. The automotive industry (78 percent) follows and with banking and insurance (74 percent) next, and completing with the ICT industry (73 percent).

It may be surprising at first glance that the ICT industry, in particular, is showing a more reserved approach. It should be pointed out that the industry is not only made up of software manufacturers, but also of hardware manufacturers. Moreover, the sample also includes suppliers of proprietary software.

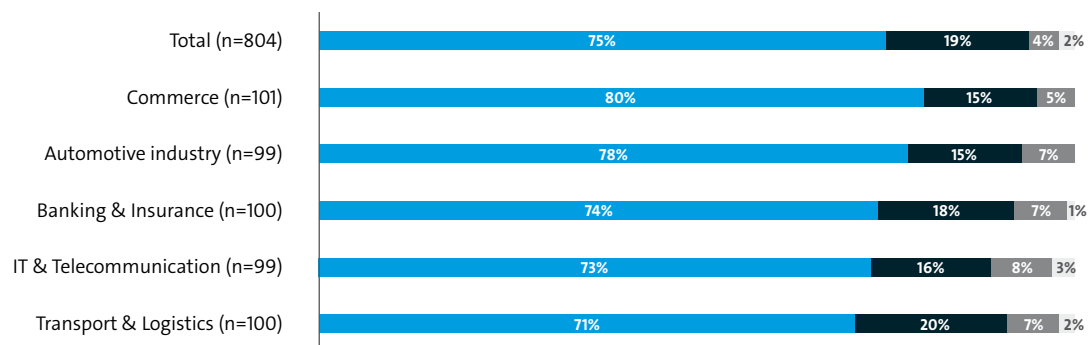


Figure 26 – Perception of / Mindset of open source software by industry
What is the general position of your company towards OSS?

Sample: All surveyed companies with at least 100 employees (n=804)
Source: Bitkom Research 2019

Interested and open-minded
Undecided
Sceptical and dismissive
No opinion / Not specified

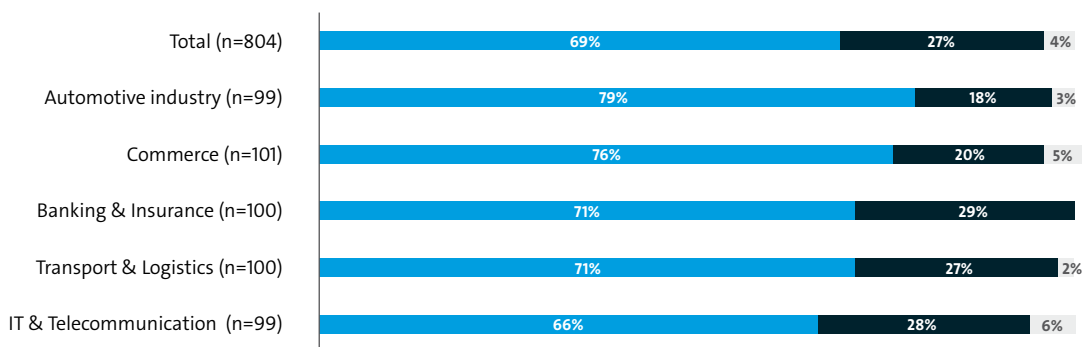


Figure 27 – Application of open source software by industry
Which of the following statements applies to the use of OSS in your company?

Sample: All surveyed companies with at least 100 employees (n=804) | Not all percentages add up to 100 as a result of rounding | Source: Bitkom Research 2019

We use OSS.
We do not use OSS.
No opinion / Not specified

The reluctance of the ICT industry towards OSS is also evident in its use (see Figure 27). Only two thirds of the ICT companies (66 percent) use OSS. This industry comes in last. Additionally, it is also the only sector that settles just below 70 percent at a total 69 percent for the use of OSS. At 71 percent, transport and logistics, alongside banks and insurance companies, score just above that. The automotive industry (79 percent) as well as commercial (76 percent) use OSS the most by far.

A glance at the application of OSS and its usage reveals that the automotive industry claims the pioneering role. Irrespective of whether using OSS internally only, integrating it into existing products or services, or making changes to the source code, the automotive industry uses OSS most frequently in almost all areas (see Figure 28). Additionally, eight percent of automotive companies consider the development of OSS as part of their core business. This statistic highlights the fact that a vehicle is no longer just the result of traditional engineering, but that software engineering has become an integral part of the product.

Moreover, the strategic use of OSS is more prevalent in the automotive and commercial sectors (see Figure 29). Almost every third car manufacturer (31 percent) and every fourth commercial undertaking (25 percent) have an OSS strategy.

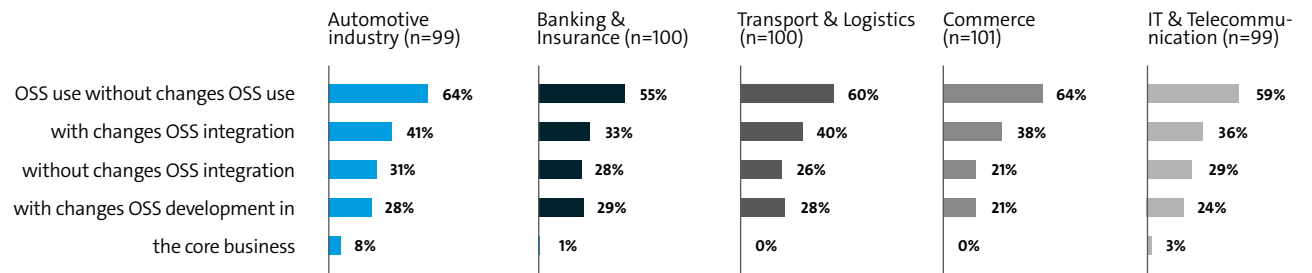


Figure 28 – Open source software application by industry

Which of the following statements apply to the use of OSS within your company?

Sample: All surveyed companies with at least 100 employees (n=804) | Multiple answers possible
Source: Bitkom Research 2019

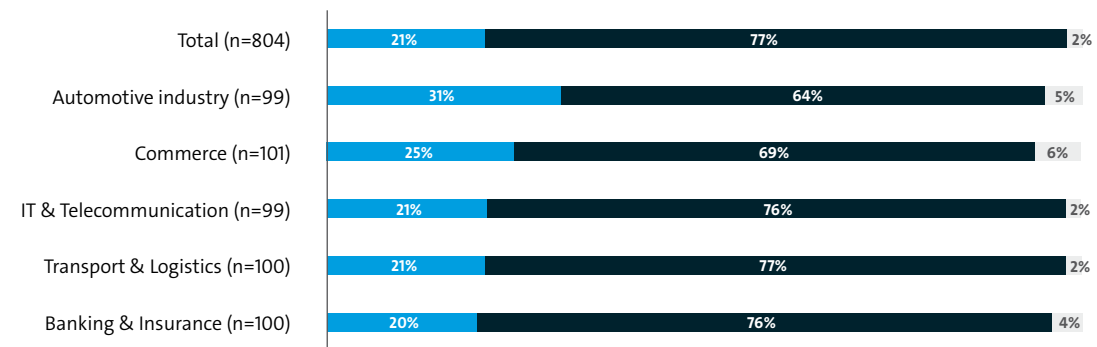


Figure 29 – Open source software strategy by industry

Does your company follow a cross-functional strategy for using or participating in OSS?

Sample: All surveyed companies with at least 100 employees (n=804) | Not all percentages add up to 100 as a result of rounding | Source: Bitkom Research 2019

■ OSS strategy
■ No OSS strategy
■ No opinion / Not specified

A quarter of the companies in the ICT industry (21 percent), transport and logistics (21 percent), as well as finance and insurance (20 percent), have one each. This reflects a continuation of the trend already apparent in the previous chapters. The majority of companies – regardless of the industry – lags behind in using OSS strategically.

However, the use of OSS within a company does not necessarily mean that a company also participates in the development or further development of OSS. Whereas the automotive industry and commerce were still taking the lead for use and application, they score only around the overall average of 31 percent for participation and support of OSS projects, thus ranking at the lower end compared to the industry (see Figure 30). Only the transport and logistics companies are less likely to be involved (24 percent). They are most likely to let their employees or teams participate in projects of the OSS community (18 percent). However, hardly any company funds the further development of OSS as a sponsor, initiates OSS projects in-house or provides the OSS source code (see Figure 31).

Finally the financial sector (38 percent) and the ICT industry (36 percent) support the further development of OSS most frequently. For example, finance and IT companies show up comparatively often as paying members or sponsors of OSS foundations (17 or 15 percent) or make the changed source code available to the OSS community again (8 or 7 percent).

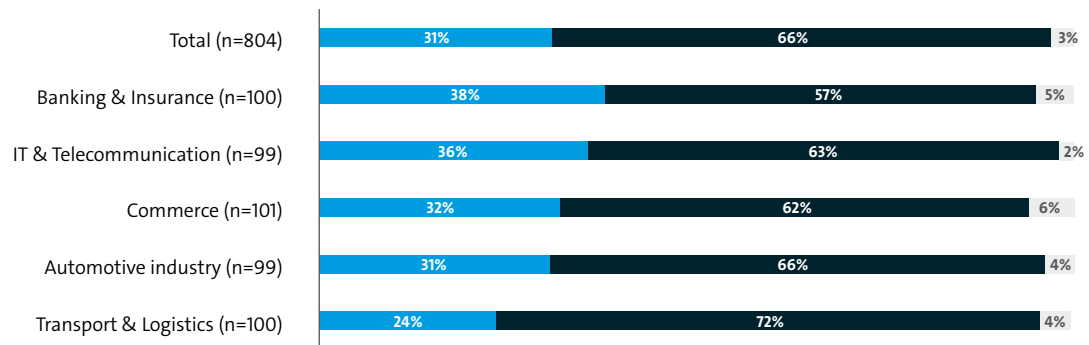


Figure 30 – Participation in open source software by industry
Does your company participate in the development or further development of OSS?

■ We participate in OSS.
■ We do not participate in OSS.
■ No opinion / Not specified

Sample: All surveyed companies with at least 100 employees (n=804) | Not all percentages add up to 100 as a result of rounding | Source: Bitkom Research 2019

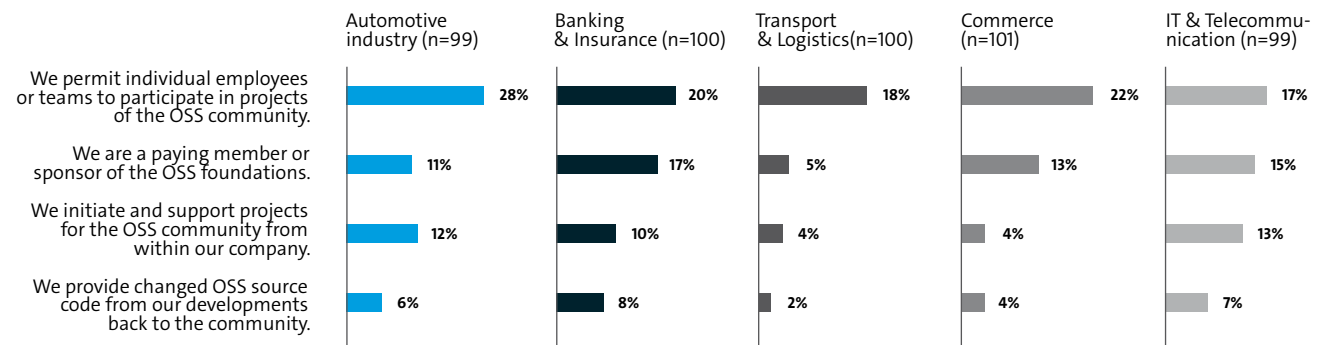


Figure 31 – Types of participation in open source software by industry

To what extent does your company participate in the development or further development of OSS?

Sample: All surveyed companies with at least 100 employees (n=804) | Multiple answers possible
Source: Bitkom Research 2019



Red Hat

Expert statement



Jan Wildeboer
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Bitkom's new research report provides robust figures for the importance of open source. It dispels any doubt that open source is the foundation of new technologies, which drive the digital transformation.

One of the positive results of the Bitkom study is that, at 4 percent, only a tiny minority is sceptical of open source. Three quarters of surveyed companies are »interested and open-minded«. However, these figures still fail to correspond adequately with the »strategic incorporation of the topic in corporate practices« and with usage.

The respective company is responsible for the content of the page.

Only every fifth company has an inter-departmental open source strategy, whereas at least 69 percent of those surveyed use open source software.

The surveyed companies use open source software in a wide variety of areas. The study also confirms that the use of open source plays a vital role in new technologies and critical components of digital transformation, in areas such as cloud computing, the Internet of Things (IoT), artificial intelligence or big data and analytics.

These areas are developing at a tremendous pace, precisely because many of these technologies are based on open source and jointly developed by the community and companies. Open source is the driving force behind these changes and the basis for extremely short innovation cycles. And – as the study suggests – this fact can no longer be contested.

Dedicated programmers in the open source world are driving the development of new solutions in community projects. The software depends on the communication, collaboration and creativity of those involved, who improve the existing solutions in an open corporate culture, develop new things, thus acting as a driving force for the digital transformation. However, only a third of the surveyed companies are actively participating in the development or further development of open source software so far. It is interesting to note that their engagement is not only motivated by financial aspects but

also by the crucial factors of motivation and staff development. One can only hope that the study will help to further promote inter-departmental and company-wide cooperation and participation in open source projects.

The results of the questions on advantages and disadvantages also illustrate the general change in the assessment of open source. Accordingly, the answers on the advantages of open source software include the high level of security, which is ensured, among other things, by continuous updates and software upgrades, second only to the central aspect of cost savings. It is not surprising that respondents regard the lack of expertise as the most significant disadvantage. It illustrates that companies currently have a great need for strategic partners in the open source segment, such as Red Hat.

At Red Hat, we are hoping that the study will help to portray open source for what it ultimately is – not »just« software, but an essential part of IT strategy. First of all, open source is a steady source of innovation that hardly any company can afford to ignore these days. Secondly, open source also represents the most crucial success factors of innovative companies, notably open communication, a high degree of transparency and creativity – and thus, a new corporate culture.

3 The outlook of open source software

The roots of the open source movement extend back several decades – even though the movement today bears little resemblance to that. Gone are the days when the development of free and open source software was dismissed as the crazy idea of a few activists. The use of open source software is widespread nowadays. Moreover, an increasing number of companies, organisations and individuals are participating in the development of open source projects. The critical voices are decreasing and becoming quieter. The figures of the Open Source Monitor 2019 are now providing the first evidence for Germany and are congruent with other studies and surveys, such as the Hype Cycle for Open-Source Software 2019.

Open source is no longer a counterculture, but an influential movement based on a broad global footing. Companies, organisations and individuals share expenses and resources, especially in technologies and technology stacks that do not enhance market competitiveness, to collaborate on further development. This cooperation is essential for the ongoing digital transformation. Long-established companies and start-ups alike are finding new opportunities to develop and establish innovative business models – despite or perhaps because of open source. Open source has thus become something greater than was perhaps intended initially.

Today, open source is deliberately used as a strategic tool to meet various contemporary challenges. The aim is to gain independence, establish new models of cooperation and to create confidence in markets and society.

The rules, values and principles of open source have remained the same since the beginning. Open source represents decentralisation, collaboration and transparency. And that will continue to be true in the future. The concept of open source will likely also find its way into other areas of life and business. On the one hand, this involves promoting open and transparent cooperation and communication, and on the other hand, seeing failure as an opportunity for innovation and further development. Ultimately, people and organisations get the chance to play an active role in improving the world, which reflects the current zeitgeist. It may not be that far off into the future that openness, freedom and transparency can thus become the fundamental nature of social action and cooperation. Examples from music and art are already taking the initial steps and providing a glimpse into the future.

Just like the three areas described previously, in which open source currently has a decisive influence already, in the future, it will be necessary to examine further questions about open source itself and find answers.

This comprises both technical and legal dimensions, but also social, economic and policy aspects. Open source and its principles assure the future viability of software innovations, in particular, and innovations, in general, that are based on the participation, individual ideas and contributions of many, not merely some. Investigating and monitoring this further is a task that we set about with the Open Source Monitor 2019 and want to continue pursuing in future studies. We invite everyone to join and support us.



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Expert statement



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Open source software not only offers companies the opportunity to reduce costs for developing software and purchasing software copyright licences, but it also opens up various options for the German economy. As a result of the knowledge transfer occurring in open source software, it can be strategically used to counter the current and presumably

increasing shortage of skilled labour, especially in the IT sector. In this context, not only the use of open source software offers opportunities, but so does the contribution to their development as it provides further training for the developers. Open source software can also further help Germany be an attractive location to do business in supporting the structural change from the traditional industry to a digital economy. Finally, open source software can also contribute to sustainability.

As digital technologies are increasingly based on open source software and corresponding, open collaborative innovation processes, open source software also contributes significantly to the 17 sustainable development goals (SDGs) published by the United Nations. Mobile access to public services, which includes education, as well as banking and other services, is increasingly based on open source software. Hence, open source software can contribute to reducing poverty and hunger as well as improving health and education. Moreover, open source software can become the basis for infrastructures and urban development, thus contributing to the reduction of carbon dioxide and sustainable economic growth. These characteristics make the open source movement a partnership that plays a vital role in achieving the sustainable development goals (SDGs). Finally, the development of open source software can be described as peer-to-peer innovation, which can be carried out in addition to

internal innovation and can therefore, generate synergies. In keeping with the development of open source software, the standardisation efforts in national, European or international bodies, such as the International Organisation for Standardisation (ISO), are also a form of peer-to-peer innovation.

Driven by the increasing significance of software for hardware-based technologies, the interface between open source software and standardisation is gaining in importance. Consequently, cooperation faces the challenge of different licensing models, which will need to be addressed in the future.



Bitkom represents more than 2,700 companies of the digital economy, including 1,900 direct members. Through IT- and communication services alone, our members generate a domestic annual turnover of 190 billion Euros, including 50 billion Euros in exports. The members of Bitkom employ more than 2 million people in Germany. Among these members are 1,000 small and medium-sized businesses, over 500 startups and almost all global players. They offer a wide range of software technologies, IT-services, and telecommunications or internet services, produce hardware and consumer electronics, operate in the digital media sector or are in other ways affiliated with the digital economy. 80 percent of the members' headquarters are located in Germany with an additional 8 percent both in the EU and the USA, as well as 4 percent in other regions of the world. Bitkom promotes the digital transformation of the German economy, as well as of German society at large, enabling citizens to benefit from digitalisation. A strong European digital policy and a fully integrated digital single market are at the heart of Bitkom's concerns, as well as establishing Germany as a key driver of digital change in Europe and globally.

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