LIONS Monitor

Individuals' Perspectives on Information Technology and E-Signatures

LIONS

funded by

dtec.bw

Funded by the European Union NextGenerationEU

1st Edition, 2024

© All rights reserved.

Publisher: Prof. Dr. Ulrike Lechner

The LIONS Monitor report is produced by the research project „LIONS - Ledger Innovation and Operation Network for Sovereignty“. The project is funded by dtec.bw – Digitalization and Technology Research Center of the Bundeswehr. dtec.bw is funded by the European Union – NextGenerationEU.

LIONS Monitor research design:
Michael Hofmeier, Isabelle Haunschild, Wolfgang Hommel

Survey conducted by:
Isabelle Haunschild, Michael Hofmeier

Data analysis:
Michael Hofmeier, Isabelle Haunschild

LIONS Monitor Project Management:
Manfred Hofmeier

Design: Artes Advertising GmbH, Munich

Printing and bookbinding:
Rechenzentrum der Universität der Bundeswehr München

ISBN: 978-3-98997-002-1
URN: urn:nbn:de:bvb:706-102817

LIONS

LIONS RESEARCH PROJECT

LEDGER INNOVATION AND OPERATION NETWORK FOR SOVEREIGNTY

The interdisciplinary research project LIONS establishes a research platform for the exploration of distributed ledger technology as a digitalization technology to increase resilience and digital sovereignty.

LIONS develops technical and analytical competencies, provides a laboratory environment with infrastructure for DLT of realistic size, and is building a community from the Bundeswehr, government agencies, and the private sector. Indicators and tools for analysis, design, and implementation of DLT-based information systems and their contribution to resilience and digital sovereignty are developed, taking into account three perspectives of analysis: (1) state or supranational institution, (2) organization, and (3) individual.

The project is funded by dtec.bw – Digitalization and Technology Research Center of the Bundeswehr. dtec.bw is funded by the European Union – NextGenerationEU.

To learn more about the project, visit the LIONS homepage at:

https://www.unibw.de/lions

Universität der Bundeswehr München

Helmut Schmidt Universität
Universität der Bundeswehr Hamburg

PREFACE

Dear Reader,

Sovereignty is the promise to act confidently in the digital space. Increasing the digital sovereignty of states or supranational institutions, organizations, and the individual is the objective of the LIONS research project. We develop concepts to analyze and increase digital sovereignty, and we build technologies to support that goal. Our research perceives the individual as a key to more digital sovereignty.

Digital identities, digital wallets, and electronic signatures are enablers for digital sovereignty as they facilitate data management, authorization of transactions and all kinds of digital asset management. Our design principle is to design in a distributed, decentralized architecture to empower the individual users.

What does it take to build a digital infrastructure for more digital sovereignty? To answer that, it is also crucial, to understand the perspective of the individuals, who are using information technology.

Therefore, this Monitor study addresses the topic of digital sovereignty from the perspective of the individual. The focus is on technology readiness, the use of information technology, and on the use of electronic signatures as an example of information systems relevant for individuals.

The survey was rolled out to participants from Germany through a third party. The questionnaire was designed in spring 2024. The online survey took place from April to May 2024. 1616 respondents took part in the survey, 1024 of which completed the questionnaire.

This study continues the Monitor series, which originated in the VeSiKi and NutriSafe projects, with the Monitor studies on information security of critical infrastructures, the NutriSafe Monitor on Resilience and Blockchain Technology in Food Production and Logistics, and the previous LIONS Monitor on resilience and digital sovereignty in organizations.

This study is conducted by the LIONS research project. We would like to thank the participants in this survey, and, above all, dtec.bw for funding the LIONS project.

Prof. Dr. Ulrike Lechner

LIONS project lead and und Professor at the University of the Bundeswehr in Munich

CONTENTS

PREFACE 05
SURVEY PARTICIPANTS 09
USE OF INFORMATION TECHNOLOGY 11
- PARTICIPANTS PREFERENCES 11
- TECHNOLOGY COMMITMENT 12
- IMPORTANCE OF INFORMATION TECHNOLOGY 14
- INTERNET USERS' INFORMATION PRIVACY CONCERNS 15

ELECTRONIC SIGNATURES 17
- SIGNATURE METHODS 17
- WHY NOT USED YET? 18
- USABILITY OF SIGNATURE METHODS 19
- TRUST ON SIGNATURE METHODS 20
- USE OF QR CODES 21

BLOCKCHAIN TECHNOLOGY 23
- PERCEPTIONS OF BLOCKCHAIN 23
- INFLUENCE ON TRUST 24

CONCLUSION 27

59%
5368.0
8564.2
34%
39%
88%

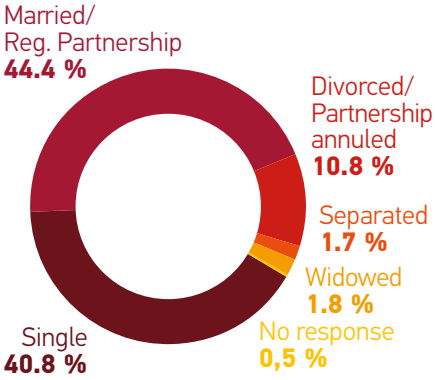
SURVEY PARTICIPANTS

The study participants are a cross-section of the German population. They provide information on how modern technologies affect them and how ready they are to use them.

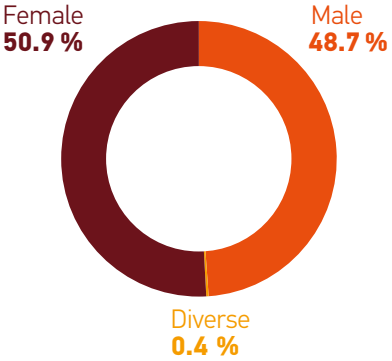
The online survey was conducted from April to May 2024 with 1343 participants (after cleansing of invalid records), 1024 of whom completed the questionnaire. The analysis in this monitor is based on these 1024 data records. All participants are located in Germany.

School education was mostly high: 41% had a high level of education with 12 or more years of schooling (German Abitur), almost 40% had a medium educational level with 10 years of schooling, and approximately 19% had a lower educational level, with 9 or fewer years of schooling.

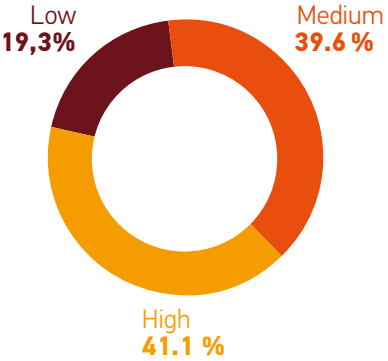
Familiy status



Gender



Education



Linux
iOS
macOS
Windows
Android

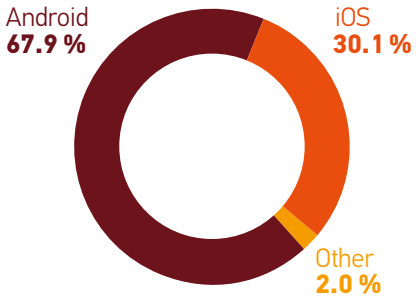
USE OF INFORMATION TECHNOLOGY

PARTICIPANTS PREFERENCES

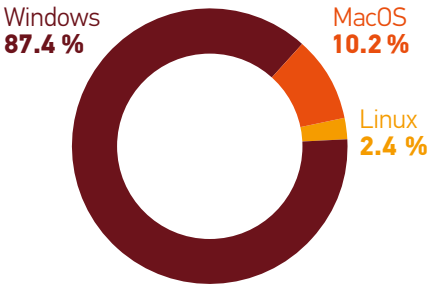
To gain a comprehensive understanding of the platforms on which participants access and interact with digital information systems, the study asked respondents to share their preferences for both mobile and desktop operating systems. This inquiry aimed to identify the devices and environments most commonly used for engaging with digital content.

The results revealed a clear trend: the majority of participants prefer Android as their mobile operating system and Windows for desktop use. These findings suggest that, despite the wide range of options available, such as iOS and macOS, users tend to gravitate toward the more universally accessible and widely adopted systems. It is known that Android's prevalence on mobile devices is likely due to its affordability and compatibility with a wide range of hardware, making it an attractive option for many users. Windows, similarly, remains dominant in the desktop environment.

Preferred operating system for mobile devices



Preferred operating system for desktop devices



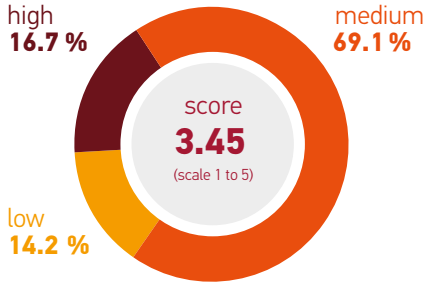
TECHNOLOGY COMMITMENT

Technology commitment (Neyer et al., 2012) describes individual differences in the willingness of technology use through three distinct facets: technology acceptance, technology competence convictions, and technology control convictions.

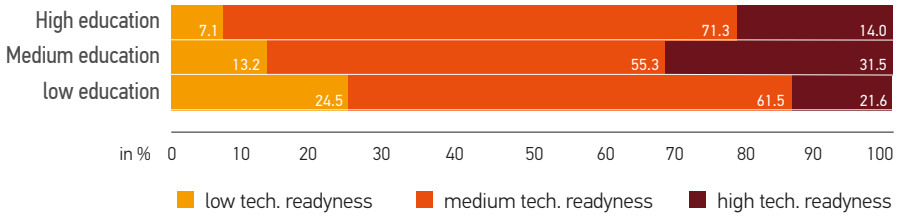
Technology acceptance relates to personal interest in new technologies, technology competence convictions refer to an individual's self-confidence and belief in their personal ability to use technology effectively, and technology control convictions address an individual's perception of the extent to which technology is controllable.

Technology commitment is considered to predict the use of new technologies, especially for older adults.

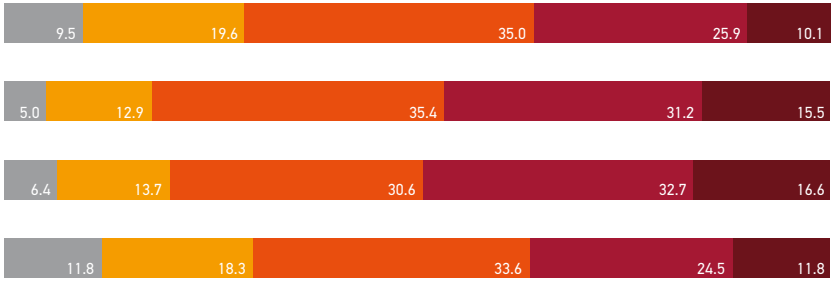
Technology commitment groups



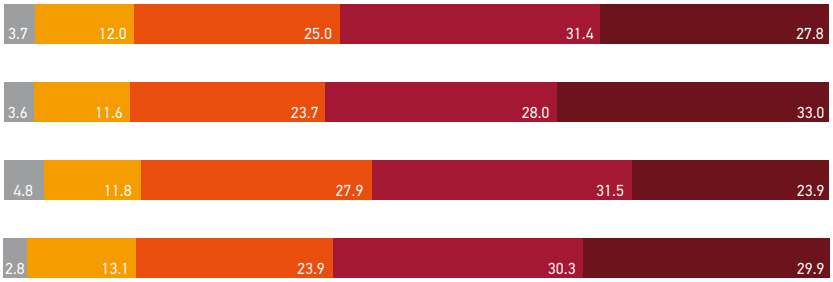
Technology commitment by level of education



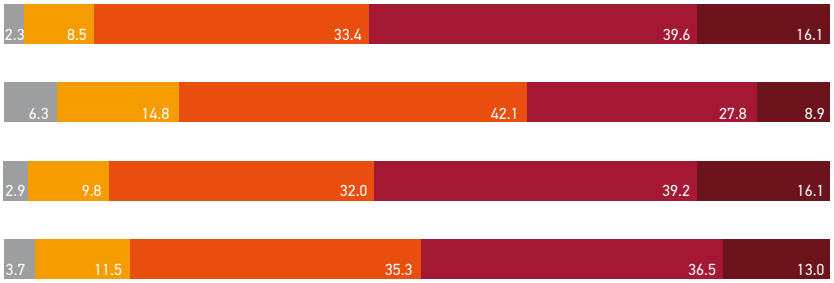
Technology acceptance

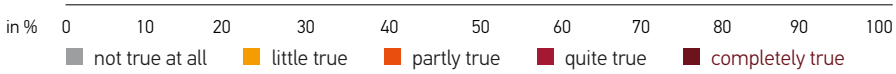


Technology competence convictions



Technology control convictions

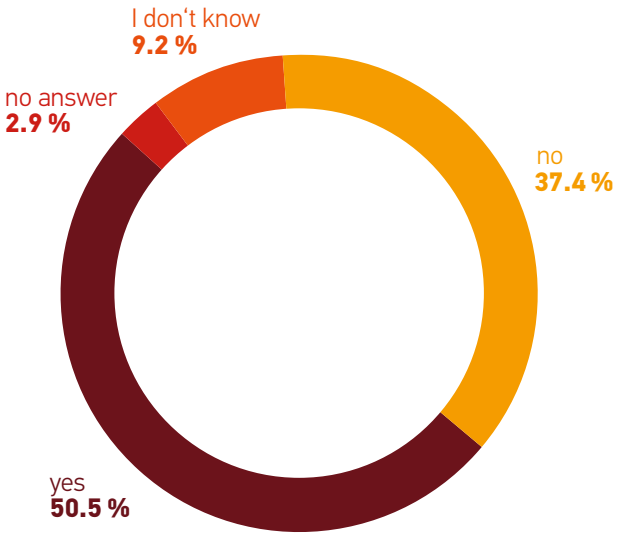




IMPORTANCE OF INFORMATION TECHNOLOGY

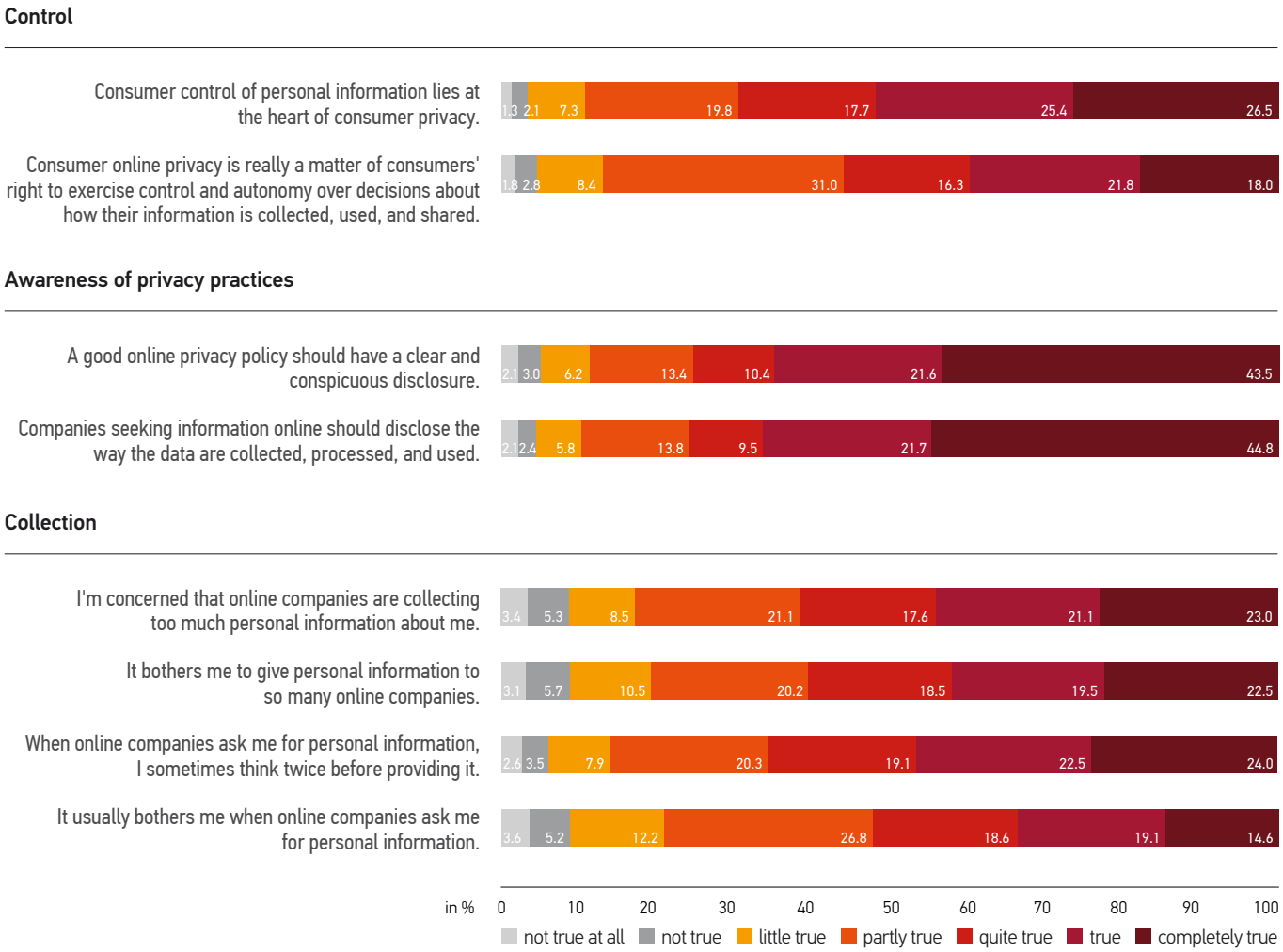
The participants were asked to assess the impact of information technologies on their professional progression. Around half of them consider these technologies to be relevant in helping them grow in their careers. This suggests that for many, digital tools play an important role in improving job performance and opening up new opportunities. However, it also indicates, that a significant portion of participants do not view information technologies as a major factor in their professional progress.

Dealing with IT is relevant for my professional progression...



INTERNET USERS' INFORMATION PRIVACY CONCERNS

These charts illustrate the significance participants place on different aspects of data privacy, using the question set of Malhotra et al. (2004). Notably, the transparency of how online companies handle and process personal data stands out as particularly important to them. This reflects a clear concern among participants for greater visibility and accountability in how their information is managed by digital platforms.

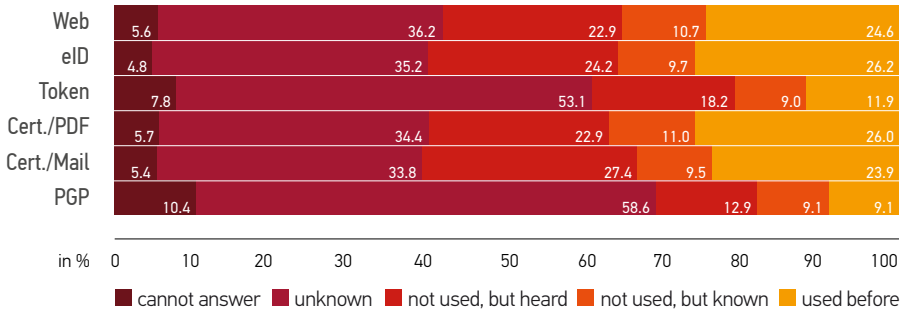


ELECTRONIC SIGNATURES

SIGNATURE METHODS

There are several methods available for electronically signing documents or data. Participants in the study were asked about six different systems. One popular option is the use of web services, which allow documents to be signed conveniently through a browser. Another is the use of a digital passport (eID), often required for official services. Hardware-based systems, such as tokens, are also an option. Digital certificates are commonly used for signing emails or PDF files. A less familiar method are PGP applications, which rely on asymmetric cryptography. However, most participants are not very familiar with these systems. For many, they are even completely unknown.

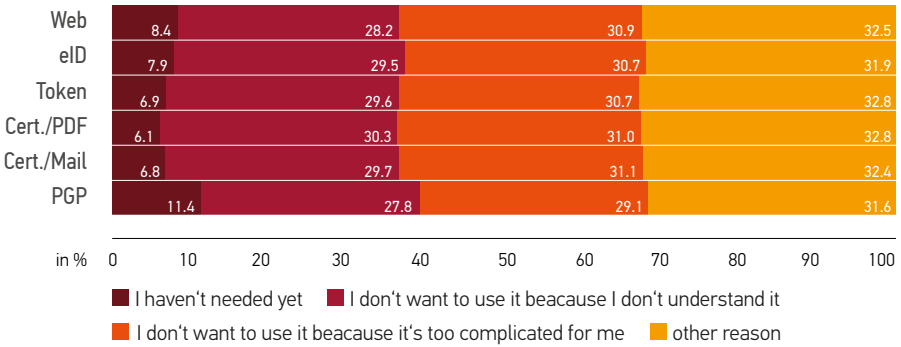
Familiarity of electronic signature methods



WHY NOT USED YET?

If participants were familiar with a system but had not used it yet, they were asked to state the reason by selecting an option. A clear trend emerged: the majority chose not to use these systems, either because they found them too complicated, or because they did not understand how they worked. Still, many reasons remain unclear.

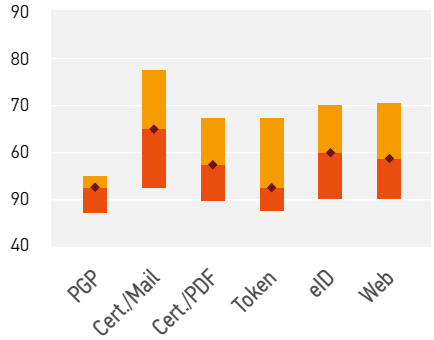
Reasons for not having used electronic signature methods yet



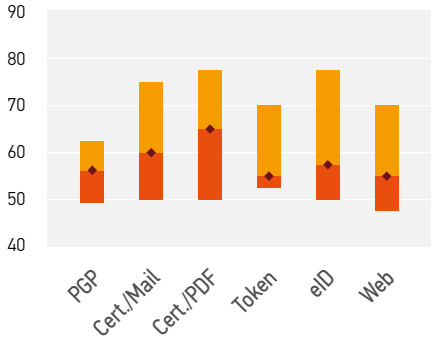
USABILITY OF SIGNATURE METHODS

If participants were familiar with a system, they were asked to evaluate its usability. To do this, established question sets (Brooke, 1996) were used, and a score between 0 and 100 was calculated. A score below 50 is deemed unacceptable – most systems only slightly surpassed this threshold. When participants were grouped by education level, the results showed little variation. However, when grouped by their commitment to technology, a clear pattern emerged: participants with a more positive attitude towards technology tended to rate the usability of these systems more favorably.

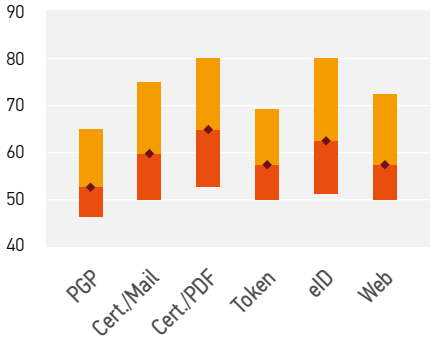
Low education



Medium education

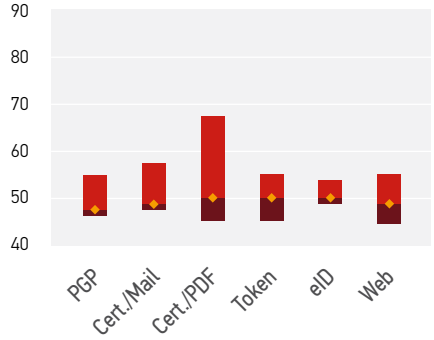


High education

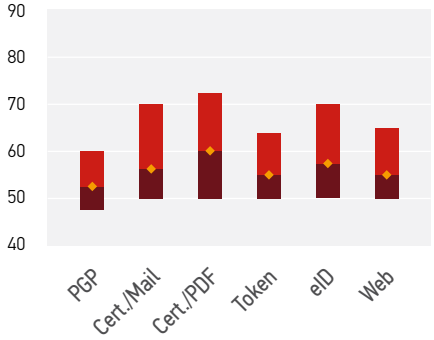


median lower quartile to median median to upper quartile

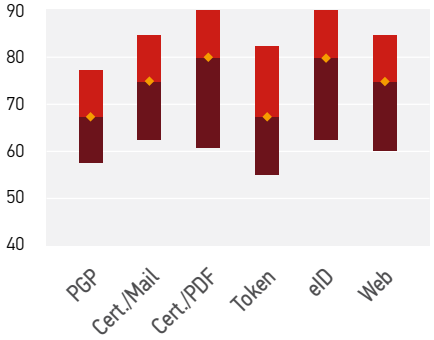
Low technology commitment



Medium technology commitment



High technology commitment

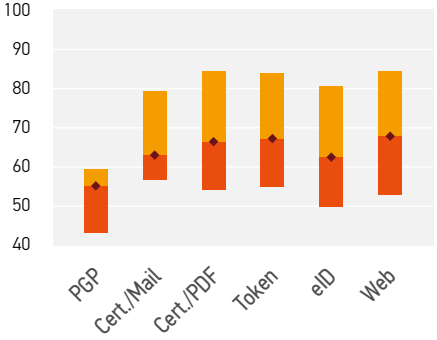


median lower quartile to median median to upper quartile

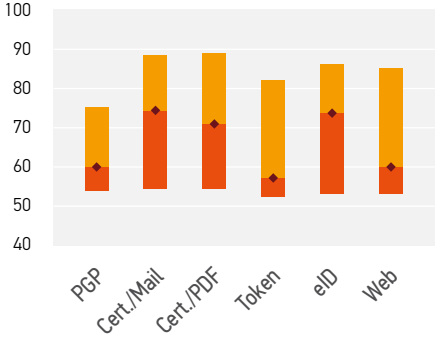
TRUST ON SIGNATURE METHODS

Participants familiar with a system were also asked to evaluate their level of trust in it. As with usability, established question sets (Jian et al., 2000) were used to calculate a score ranging from 0 to 100. The education level (page 9) is only associated with trust in the case of PGP. However, a participant's commitment to technology has a significant impact on their trust across all systems, with those more engaged in technology showing notably higher levels of confidence in the systems.

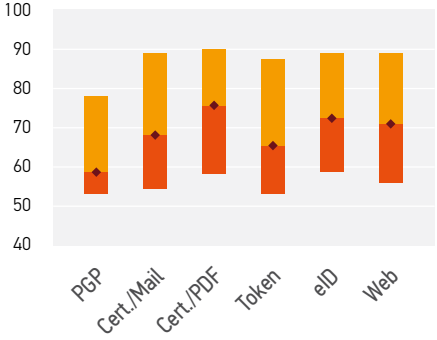
Low education



Medium education

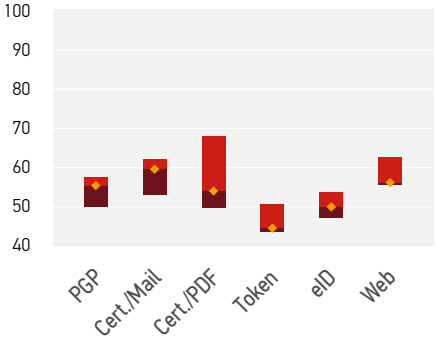


High education

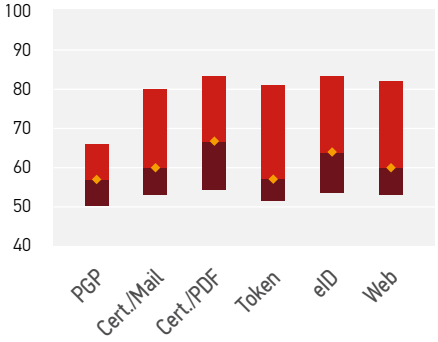


median lower quartile to median median to upper quartile

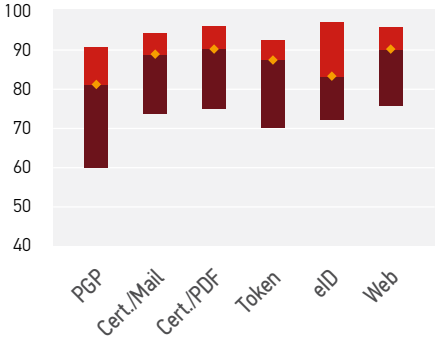
Low technology commitment



Medium technology commitment



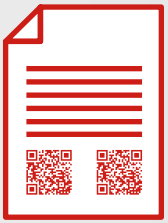
High technology commitment



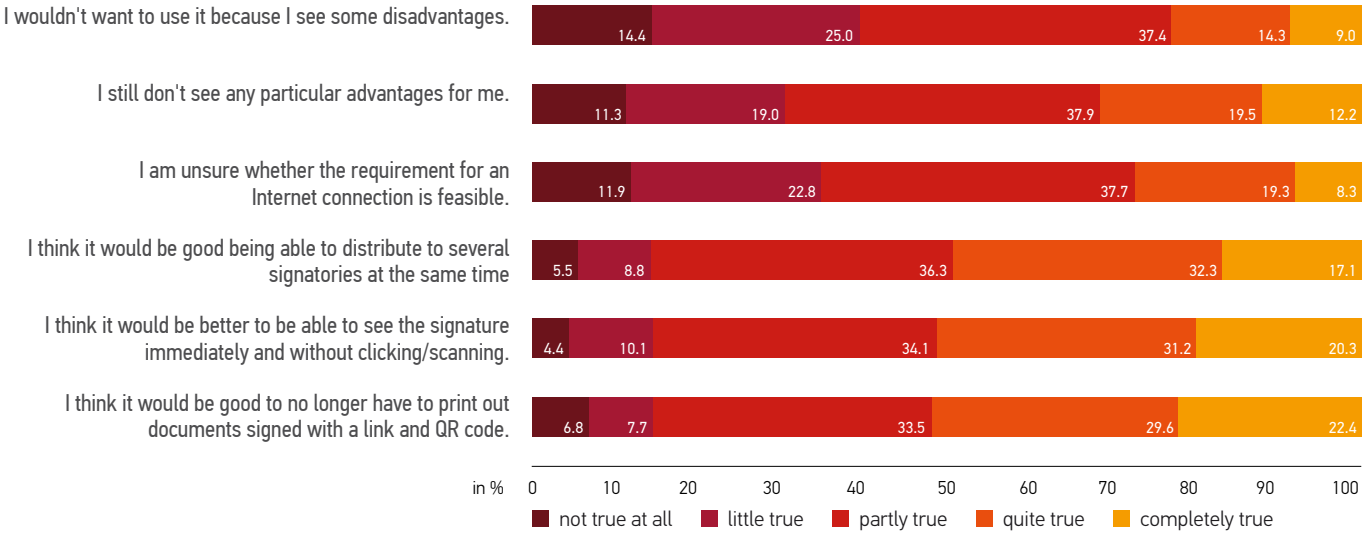
median lower quartile to median median to upper quartile

USE OF QR CODES

Looking ahead to future system designs, the study examined the acceptance of using QR codes combined with URLs (links) as placeholders for signatures. By clicking on these links or scanning the QR codes, users can either access the signature information or, if no signature has yet been submitted under that link, have the option to provide their own signature. This method allows for a streamlined and flexible approach to digital signatures.



Use of QR codes as placeholders for signatures



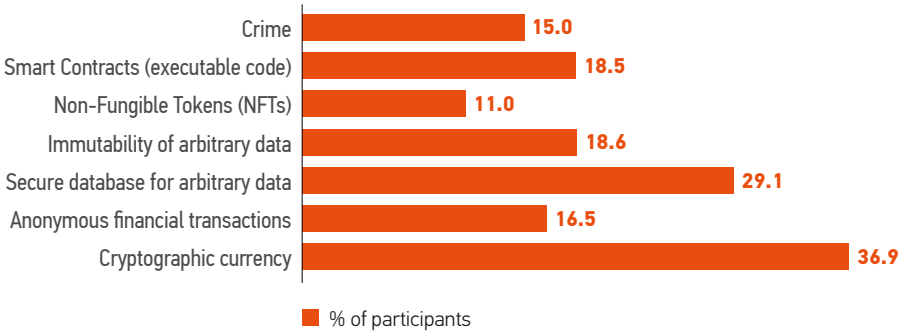
BLOCKCHAIN TECHNOLOGY

PERCEPTIONS OF BLOCKCHAIN

Blockchain technology is a decentralized, digital registry that stores transactions in a chronological chain. It is secure, because every transaction is protected by cryptographic methods and unchangeable. This structure enables transparent and trustworthy transactions without a central authority. Therefore, it is also the foundation of, e.g., cryptocurrencies.

This chart shows how many participants associate the term "blockchain" with each of the following terms. The participants had to decide for each term individually whether they see a connection. This shows, that the majority of participants make no connection between the term "blockchain" and the term "cryptocurrency", which suggests that many people might not be aware of the technological basis of cryptocurrencies.

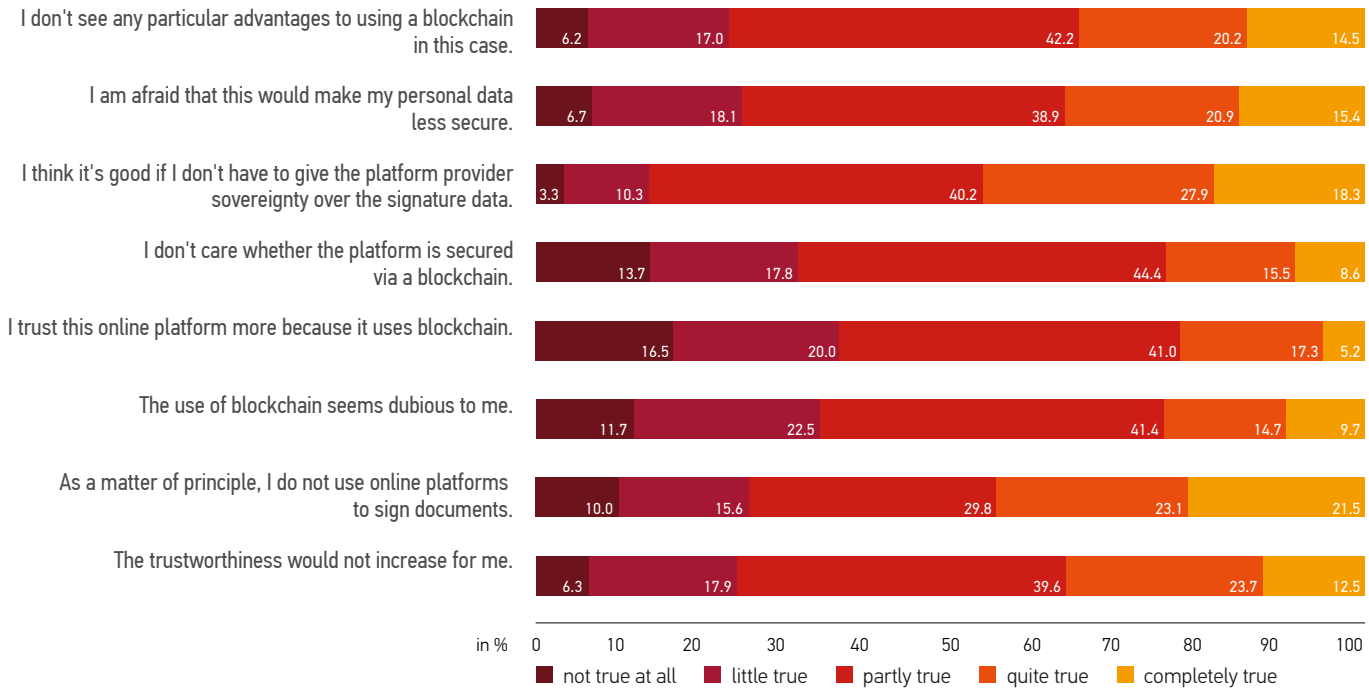
Associations with the term "blockchain"



INFLUENCE ON TRUST

The principle of blockchain technology increases the trustworthiness of systems by decentralizing the truth of the data. However, the impact this has on the end user is also to be considered when implementing a blockchain into a system. In particular, the question of whether this increases the subjective trustworthiness is interesting and important. A look at the results shows that the influence on the end users' perceptions is rather limited.

Use of blockchain technology to prevent forgery of signature data on online signature platforms



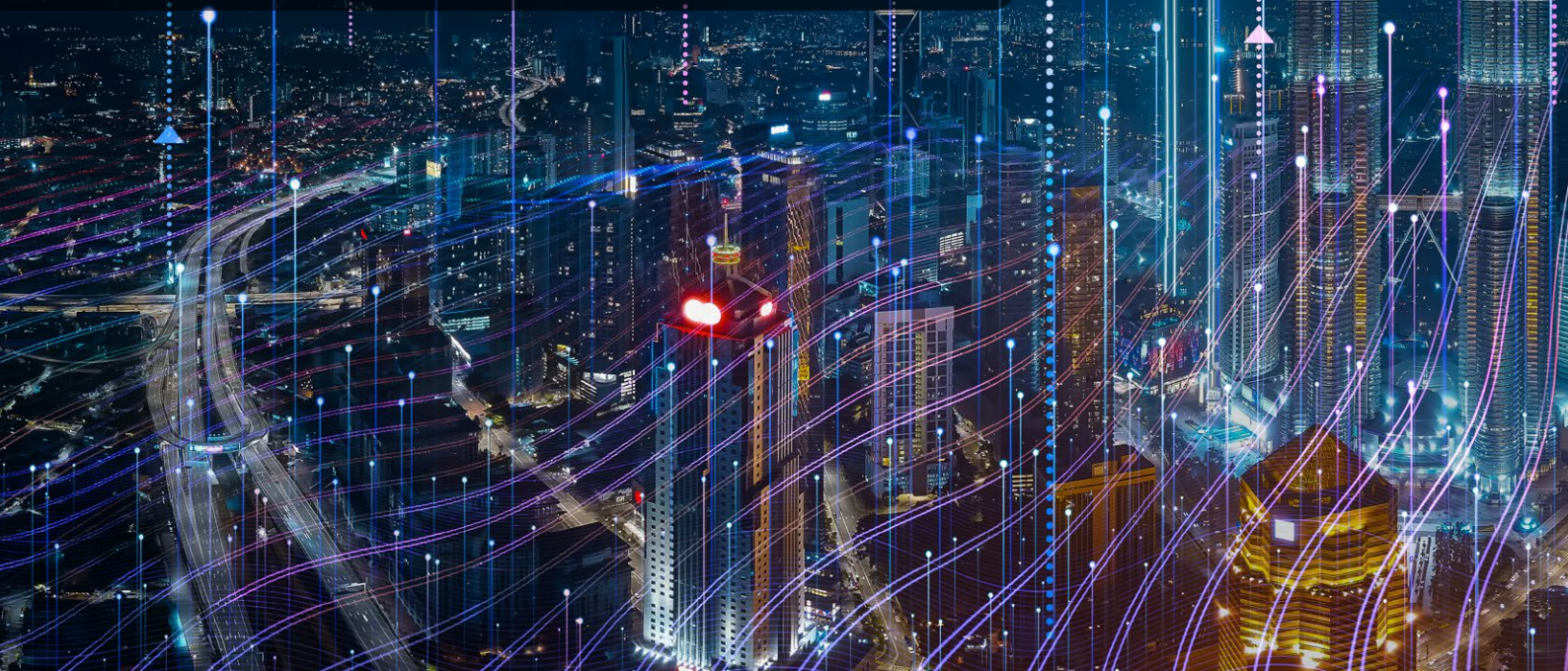
TRUST
BLOCKCHAIN

CONCLUSION

This study, conducted with a diverse sample of the German population, provides valuable insights into technology use and attitudes. The preference for Android and Windows highlights their dominance in mobile and desktop environments. Technology commitment plays an important role in how participants perceive and use digital tools, with many acknowledging the role of technology in professional advancement.

Data privacy is a major concern, with participants prioritizing transparency in data handling by online platforms. The study also revealed varying familiarity with electronic signature methods, showing that web services, digital passports, and the use of digital certificates are well-known, whereas PGP remains less familiar. Usability and trust in these systems are associated with participants' commitment to technology.

Innovative approaches like QR codes for signatures were explored, offering a flexible method for digital transactions. Despite blockchain technology's promise of security and transparency, its impact on user trust remains limited. Overall, the study underscores the importance of making digital technologies more accessible and understandable to enhance user engagement and trust.



ACKNOWLEDGEMENTS

This work originated in the LIONS research project. LIONS is funded by dtec.bw – Digitalization and Technology Research Center of the Bundeswehr, which we gratefully acknowledge. We also thank the study participants and the disseminators for spreading the survey.

REFERENCES

Brooke, J. (1996). SUS: A quick and dirty usability scale. Usability Evaluation in Industry.

Jian, J. Y., Bisantz, A. M., & Drury, C. G. (2000). Foundations for an empirically determined scale of trust in automated systems. International journal of cognitive ergonomics, 4(1), 53-71.

Malhotra, N. K., Kim, S. S., & Agarwal, J. (2004). Internet users' information privacy concerns (IUIPC): The construct, the scale, and a causal model. Information systems research, 15(4), 336-355. 10.1287/isre.1040.003

Neyer, F. J., Felber, J., & Gebhardt, C. (2012). Entwicklung und Validierung einer Kurzskala zur Erfassung von Technikbereitschaft. Diagnostica, 58(2), 87–99. https://doi.org/10.1026/0012-1924/a000067

More information on the LIONS project is available on the website

https://www.unibw.de/lions

A digital version of this report is available at

https://www.unibw.de/lions/monitor

This report is created by LIONS

Institute for Protection and Dependability
Department of Computer Science
Universität der Bundeswehr München

Prof. Dr. Ulrike Lechner
Werner-Heisenberg-Weg 39
85577 Neubiberg
Germany

Tel: +49 89 6004-2504/-2207

LIONS Monitor contact:
Manfred Hofmeier
Tel: +49 89 6004-3392
Email: manfred.hofmeier@unibw.de

LIONS