



GERMAN STANDARDIZATION PANEL 2022

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# GERMAN STANDARDIZATION PANEL (DNP)

Standardization Research,

Policy and Promotion

## Indicator Report 2022

» Standards, Standardization and Climate Change

SUPPORTED BY DIN AND DKE

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### CONTENTS

- 03 Greeting from the Minister of Economy and Climate Action
- 04 Authors
- 06 Executive summary
- **09** Creating an empirical basis for the exploration of the German standardization landscape
- **15** The importance of standards and specifications
- 22 Standardization activities
- 27 Certification of management systems
- 29 Effects of the covid-19 pandemic on standardization
- 33 Standards, standardization, and climate change
- 41 Conclusion
- 43 Survey details
- 44 Glossary

## MESSAGE OF GREETING



### **from Dr. Robert Habeck** Federal Minister for Economic Affairs and Climate Action

### for the 2022 German Standardization Panel

In almost all areas of life and business, we rely on standards. We need them to make sure that electric cars can be recharged at public charging stations and that our paper fits into every printer and photocopier. Numerous products and services work across borders and regardless of producer and provider only thanks to precise standards.

This also applies to climate and environmental technologies. Standards can make an important contribution to a climate-neutral and sustainable economy. They help companies to comply with technical provisions and to open up new markets for climate-neutral and sustainable products. This is also confirmed by the results of the current tenth survey that was carried out by the German Standardization Panel (DNP).

We need to work together at international level to successfully combat climate change. The Federal Ministry for Economic Affairs and Climate Action has therefore put this item on top of the agenda of Germany's G7 Presidency. We also need to make ourselves fit for the task throughout Europe. We need to join forces in Europe and speak with one voice in the field of international standardisation work. I am therefore delighted that the European Commission is addressing the topic of climate action in the new Standardisation Strategy.

Working closely with representatives from business, standardisation, government, academia and research, we can succeed in rapidly creating the policy framework needed for the green transformation. At the same time, standardisation work can help to intensify global cooperation – to the benefit of the climate and progress.

I congratulate the German Standardization Panel on its tenth anniversary. The annual survey to collect data on the standardisation activities of companies generates important new scientific findings in the field of standardisation research.

I wish all the readers of this year's Indicator Report interesting and valuable insights.

Rost Hasz



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# GERMAN STANDARDIZA-TION PANEL 2022

YEARLY INDICATOR REPORT FOR THE IMPORTANCE OF STANDARDS AND STANDARDIZATION ACTIVITIES OF GERMAN COMPANIES

### SUMMARY

The Indicator Report 2022 of the German Standardization Panel (DNP) provides information on various standardization-related topics based on a representative database of standardization-active companies, supplemented by companies that only implement standards. While the contribution of innovations to the competitiveness of companies and other entrepreneurial dimensions has long been undisputed, the benefits of standardization or the application of standards have only been recognized as an essential influencing factor in recent years. This is due to a lack of findings from empirical studies due to insufficient data availability.

For this reason, the DNP was initiated in the fall of 2011 by the German Association for the Strengthening of Research on Standardization e. V. (FNS). The FNS had the objective of promoting research on topics and issues relevant to standardization to make scientifically sound statements on standardization policy aspects. In the meantime, the German Standardization Panel is commissioned and accompanied by DIN and DKE. Annual surveys conducted as part of the DNP collect data that contribute to an inventory of standardization activities and enable the impact of standards and standardization on various economic and social dimensions to be examined. In 2016, the Federal Ministry of Economics and Climate Protection (BMWK) took patronage.

A systematic analysis requires a detailed, reliable database for this purpose. In particular, panel data is necessary for research into the complex effects of standardization processes and the application of standards on corporate success. This is information from a survey conducted among the same economic actors (individuals or companies) on the same topic over a more extended period. This year, data from ten waves of the DNP can be linked to form such a panel. Based on this unprecedented dataset, insights into changes in standardization behavior and the use of standards by companies from 2013 to 2021 will be gained. Unfortunately, the pilot study in 2012 cannot be considered for the panel data set due to an insufficient number of observations. The here presented analysis validate last year's results and confirm initial trends. In addition, new insights into the trend towards standardization could be gained. The following core results were derived:

- Formal standards, specifications, and other technical rules developed by standardization organizations are the most essential documents to the participating companies, as they promote legal certainty and facilitate market access. However, over time, a slight reduction of the importance of standards at the national and EU level can be noted, while consortia standards gain prominence, especially at the international but also at the EU level.
- 2 Internal company standards are the third most important document type and are considered more relevant than informal consortia or de-facto standards. Internal company standards are applied by most businesses surveyed, but particularly by large and innovative companies. They serve primarily to promote quality and productivity improvements. Over the last few years, internal company standards have become important, specifically among medium-sized companies. Smaller companies use these standards to improve bargaining positions, vis-à-vis suppliers and customers.
- 3 Informal consortia and de-facto standards are primarily relevant for the realization of technical interoperability. Participation in consortia is mainly motivated by the high speed of processes. At the same time, the type and number of users and the possible influence on government regulation are perceived as an advantage in formal standardization.
- 4 On the one hand, ISO 9001 (quality) and ISO 14001 (environmental) certifications are already widespread among survey participants, so a decline in initial certifications is now apparent. On the other hand, the most substantial growth in certifications in recent years has been in the DIN EN ISO 50001 standard (energy efficiency). In addition, certificates according to ISO/IEC 27001 (IT security procedures) are rising, especially among larger companies.
- 5 Climate change is very relevant for standardizing companies. Its importance is designated to increase in the future. All types standards are perceived as effective means of mitigating climate change, and their potential has not yet been exploited. More information exchange with the scientific community, closer international cooperation, and more coordination with legislators were assessed as the most effective measures for improving climate change through standards.
- 6 Standardization activities remained constant in the second year of the covid-19 pandemic. The majority of standardizing companies planned to maintain or even expand their participation. The importance of various standards also did not change significantly for the companies due to the crisis. The transition of standardization processes was associated with a strong digitalization effect. This reduced costs, increased efficiency, and enabled more (international) participation. In contrast, informal, personal exchange was lacking for many standardization experts.

## CREATING AN EMPIRICAL BASIS FOR THE EXPLORATION OF THE GERMAN STANDARDIZATION LANDSCAPE

### Introduction

Innovation is commonly regarded as a source of growth and prosperity. Many factors contribute to the transformation of ideas into successful market solutions. Standardization is considered one of these factors. This is underlined by the fact that the OECD's Oslo Manual<sup>1</sup> in 2018 included it as such for the first time. Panel data, i.e., gathered regularly, facilitates causal inference and is, therefore, necessary for the scientific analysis of the effects of standards. For example, the 2012 survey revealed that companies active in standardization invest more in innovations and realize their innovations with higher success<sup>2</sup>. This correlation, however, does not necessarily imply that participation in standardization positively affects the innovativeness of companies. Instead, innovative companies could be more likely to become active in standardization. To define directions and sizes of effects, companies' activities have to be observed over a more extended period.

Inspired by the innovation survey carried out among EU Members by the European Commission, which started in the early 1990s, the DNP generates a comprehensive collection of empirical data containing a large amount of information on businesses, which can be used to explore central issues in standardization research.

### Goals

The data generated by the DNP forms a basis for scientific research on the standardization activities of companies, the implementation of standards, and the effects of standards on entrepreneurial success. The survey results can also be used to develop strategies for involvement in European and international standardization and to articulate national business interests, among others, towards the European Commission.

An additional goal of the German Standardization Panel is to address current standardization policy issues and evaluate measures taken. The last survey waves addressed the impact of the Covid-19 pandemic and the importance of the United Nations Sustainable Development Goals for standardization. In addition, the DNP data allows for the identification of new trends, capturing the impact of economic and geopolitical events, such as the corona crisis and climate change, which are relevant to standardization.

Finally, the panel raises awareness of the importance of standardization for businesses that have not yet used formal standards or have not yet been active in standar-

<sup>&</sup>lt;sup>1</sup> OECD and Statistical Office of the European Communities (2018): "Oslo Manual. Guidelines for Collecting and Interpreting Innovation Data, 4th Edition", https://www.oecd.org/science/oslo-manual-2018-9789264304604-en.htm

<sup>&</sup>lt;sup>2</sup> Blind, K. und Rauber, J. (2013): "Normung als attraktive Plattform für innovative Unternehmen", DIN-Mitteilungen December 2013, P. 26 – 29

<sup>&</sup>lt;sup>3</sup> This is the Community Innovation Survey (CIS) panel survey, in which companies are repeatedly asked about their innovation activities, problems and successes.

dization, thus motivating and encouraging increased participation. This requires wide dissemination of the survey results via reports such as this one. The DNP is designed to help achieve these goals of standardization research, policy, and promotion.

### DNP special sections since 2012



### **Heuristic Model**

Figure 1

The annual survey is divided into core questions and a topic-oriented special section. The DNP core survey is based on a heuristic impact model (see Figure 1). This model is comprehensive enough to integrate the broadest possible range of questions. In particular, the model depicts the multidimensional relationships between standardization participation and standardization, the implementation of norms or standards, and corporate success. To characterize standardization activities, the model primarily records the type and scope of standardization work, such as time and personnel expenditure or involvement within standardization committees.

The various cost and benefit dimensions are surveyed in the area of standards implementation. In addition to these aspects, which are aimed more at the development processes and the implementation of standards, the DNP has the long-term objective of recording the effect of standardization and the application of standards on the success of companies. GERMAN STANDARDIZATION PANEL 2022 11

### Realization

Method On October 14, 2021, World Standards Day, the tenth wave of the DNP company survey, went into the field. The project is conducted by the Department of Innovation Economics at the Technical University of Berlin and is financed and advised on content by DIN and DKE. In 2021, the German Federal Ministry for Economic Affairs and Energy (BMWi) again gratefully assumed the patronage of the DNP.

A total of more than 35,000 experts were contacted. Unfortunately, the number of usable questionnaires is around 1,877, so the response rate of just under 5 % is slightly lower than in the previous year. Nevertheless, a high response rate to the special section shows that the topic of the impact of the Corona pandemic has met with great interest.

In 2020, more than 2,500 participants took part in the survey, corresponding to an increase of 1.5 from the previous participants. This increased participation rate was partially maintained this year because the number of participants in this wave exceeded that of the pre-pandemic surveys. In addition, a large number of usable answers in this year's two special parts show that the topics "Covid-19 and standar-dization" and "Standards, standardization and climate change" arouse great interest and that the investigated areas impact the everyday life of standardizing companies.

Panel dataData from 246 companies that had already participated in the 2013 and 2014 surveys could be analyzed this year. A balanced panel data set was formed on this basis.<br/>To obtain a detailed overview of the development of various indicators over the entire survey period resulting from the individual samples of the respective years were also compared. The companies' responses were weighted based on company size and assigned industry to enable more robust comparability and a sufficient degree of representativeness. The target distribution was an estimate of the distribution of company size and sector allocation of the companies active in standardization at



DIN, which was compiled based on a database containing almost 10,000 companies<sup>4</sup>.

Based on this data set, which is unique to date, insights can be gained into changes in standardization behavior and the use of standards by companies over time. Unfortunately, the user perspective on standardization has been underrepresented in research and the standardization process.

### Composition of the sample 2021

In this indicator report, industry affiliation, company size, and research and innovation activities are the main distinguishing criteria used to structure the results and highlight individual special features. The sample composition in the survey in 2021 is roughly the same as in previous years. The structures of the sample of experts and companies participating in the DNP have been confirmed.

**Participants** Of the nearly 1,900 responses used in the analysis, 64 % represent companies or groups of companies. 36 % of the responses are the views of experts who are answering on behalf of a representative company in their sector. For smaller companies with up to 50 employees, most of the responses were from a management or plant management representative. For larger companies, the participants were primarily based in research and development departments. Participants frequently stated that they had a specialized standardization background in companies with more than 1,000 employees (n = 131). Overall, 19 % of participants were from management or operations, 21 % were from research and development departments, and 10 % were from dedicated standardization departments and had a quality management background. This corresponds to the distribution in previous years.

Provenance & As in previous years, the leading group of companies responding to the survey was German companies. At just under 80 %, these made up the largest group of participants. Most foreign participants came from Europe (14 %), followed by the USA (3 %) in third place. The size distribution of participating companies has remained relatively stable since 2013. Each group formed according to company size contains, in each case, approximately one-quarter of the participants (Classification: < 50, 50 - 249, 250 - 999, 1,000+ employees). It was thus also possible to represent the views of small and medium-sized enterprises (SMEs, <250 employees), which account for 48 % of the sample. While the share of smaller companies was highest in the service sector (>50 %), responses from groups of companies with 1000+ employees came mainly from electrical engineering and vehicle manufacturing.

Industries At around 12 %, most of the participating companies are active in mechanical and plant engineering (n = 220), followed by 11 % each from electrical engineering (n = 201), 7 % each from the construction industry (n = 132) and the chemical, pharmaceutical, rubber and plastics (from now on referred to as "chemical and pharmaceutical industry") (n = 122) and the vehicle manufacturing sector (n =129). In contrast, only 1 % of the companies were active in the information and communications (ICT) sector (n = 26). Compared with the 2020 survey, the proportion of participants from the electrical engineering sector has increased slightly, while the number of participants from the universities, clubs, and associations sector has decreased somewhat. However, the high number of participants from the constructions.

tion industry was maintained as last year (see Figure 3).

### **Research & Innovation**

The innovation activities of companies seemed to either increase slightly or remained at a constant level compared with the previous year's survey. For example, 63 % of the 1,199 responding participants stated that they had introduced product innovations and 56 % process innovations during the last year, while this figure was still 71 % in the 2020 survey (n = 1214). A comparison of the weighted samples confirmed a slight increase. (Internal) research activities were carried out by 55 % of 788 companies, while 40 % cooperated with external research institutions. The proportion of companies that carried out innovations conducted research, or entered a research and innovation cooperations was lower among SMEs (just un-

Mech. Eng. and Plant Constr.					220
Electrical Eng.				20	1
Construction			132		
Certification and Testing			132		
Automotive Eng.			129		
Public administration			123		
Chemicals and Pharmaceuticals			122		
Research org., assoc., federations			119		
Metal Production			104		
Medical Eng. and Optics			96		
Prof./Scient. Activities			93		
Energy, Water, Oil		75	5		
Other		66			
Consumer Goods Production		60			
Other services		48			
Information and Communication	26	1			

der 15 %) than among very large companies (36 %). Electrical engineering companies were the most likely to report having introduced product innovations (79 %), followed by manufacturers of consumer goods (78 %) and medical technology and optics (67 %). The highest proportion of research companies was in metal production (71 %), vehicle manufacturing (70 %), and medical engineering and optics (67 %), while the lowest proportion of researching companies was in the service sector (32 %). Companies in the construction industry (53 %) and electrical engineering (45 %) cooperated most frequently with external research institutions.

Of the 809 companies that provided information on their export activities in 2020, 75 % were going to the EU, 50 % were in the USA, and 57 % were in Asia. The sectors with the highest export shares were mechanical and plant engineering (58 %) and vehicle manufacturing (52 % each), medical technology and optics (50 %), and the

### Figure 3

Number of participants by industry

Export metals industry (49 %). The highest average share of sales from exports to Asia was in mechanical and plant engineering (21 %), followed by electrical engineering (17 %). The largest corresponding share of exports to the USA was recorded by the information and communications industry (15 %) and medical technology and optics (12 %). Within the European Union, the metal industry has the highest export share with 50 %, followed by the information and communication industry with 49 % and the automotive industry with a share of 46 %.

## THE IMPORTANCE OF STANDARDS AND SPECIFICATIONS

In its first core part, the annual survey of the German Standardization Panel collects the assessments of companies from different industries on the importance of standards. The survey distinguishes between five types of measures: Formal standards such as the DIN standards, technical rules or specifications (e.g., DIN SPEC), informal consortia standards, de-facto standards, and internal and external standards company standards. Except for the latter, their importance is measured at the national, European, and international levels. In the case of formal criteria, for example, this refers to DIN standards (national), the European standards EN (CEN, CENELEC, or ETSI), and ISO standards (international).

## Formal standards remain the essential type of standard, especially at the European level

With the help of the data collected in the core section since 2013, possible changes concerning the perceived importance of standards and the impact of various standards on the success factors of companies were examined. The companies' perceptions pointed in two directions. On the one hand, the importance of standards remained essentially constant compared to previous survey waves. However, on the other hand, approval of the importance of standards for various success factors decreased even further than last year (see Figures 6 and 8).

The most considerable differences in assessing the importance of standards were



#### Importance of standards

Average rating of the importance of norms and standards at various regional levels.

Rating scale from -3 (very unimportant) to +3 (very important). N=1,818 -1,862



found between firms that could be assigned to the secondary or tertiary sector. While the secondary sector attaches more importance to formal standards at the European level and (internal) plant standards, the tertiary sector is more nationally oriented and perceives the importance of plant standards at the same (low) level as consortium standards. This picture did not change in 2021: Differences between the means (2021 versus 2020, or 2021 versus 2013 to 2019) are not statistically significant. Only the decrease in the importance of company standards shows a significant negative development in recent years.

External company standards are often set by companies downstream in the value chain. They are particularly important in the chemical, pharmaceutical,

#### Importance of standards by industry +3 Medical Eng. Mech. Eng. and Plant and Optics Chemicals ٨ constr. international and Pharmaceut Formal Stan-Automotive... icals dards +2 Electr. Ena Energy, Consume Water, and Goods Metal Production Oil Production Services Automotive.. Medical Eng. and Optics<sup>Chemicals</sup> +1 and Consumer Pharmaceut Goods... ●Energ⊮als Electr. Eng. Construction Water, and Other Oil Consortia Metal Production **Standards** Services 0 +1 +2 +3 Mech. Eng. and Construction Plant constr. national > -1 +3 external +2 Electrical Eng. Autom.otive Eng. Mech. Eng & Med. Eng Consumer Plant Const. & Optics Good +1 Company Services. Standards Chem. & Pharm 0 +2 +3 Metal Prod. Enerav. Water, Oil internal > -1

### Figure 5

Importance of national and international formal standards and consortium standards, as well as internal and external company standards by industry. -3 (very unimportant) to

+3 (very important). Total N=1,862. GERMAN STANDARDIZATION PANEL 2022 17

Internal Company Standards

**External Company Standards** 

+3 Very

### Figure 6

Average assessment of the impact of different types of standards on success factors. -3 (very negativ) - +3 (very-

positive).

### Impact of standards on success factors

Standards **Technical Rules and Specifications Consortia Standards Defacto-Standards** 



### Figure 7

How important are the following types of standards and standards for your company at ... level? scale -3 (very unimportant) to +3 (very important), N=10,961

#### Importance of Standards 2013 - 2021



and metal production sectors. In these sectors, they are valued for quality and productivity improvements, as well as for improving the negotiating position vis-à-vis suppliers and customers. Very large companies and companies involved in international standardization in particular value them as important.

De-facto and informal consortium standards are rated as less important on average. However, they play a role in the realization of technical interoperability and, to some extent, in quality enhancement for large, innovative companies that are part of a multinational group. The construction industry, in particular, does not rate this type of standard as important on an international level. On average, participants attach the greatest importance to European standards and, overall, to all types of European standards. This is especially true for formal standards and de-facto standards. The energy sector and metal production rate the importance of these standards particularly highly, while the service sector attaches minor importance to them.

In contrast to other sectors, national standards play a greater role in the construction and service sectors than international standards. Standards at a higher level are more important for consumer goods manufacturers. The most internationally oriented sectors are optics, medical technology, chemicals, and pharmaceuticals. At this level, formal standards are considered most important. On the other hand, companies from the electrical engineering sector and vehicle manufacturing attach great importance to international consortium standards. Contrastingly such standards are considered unimportant (negative mean) exclusively by the construction sector, as in the previous surveys.

## Greatest influence on success factors through formal standards and technical rules, specifications

Overall, the assessment of the previous surveys that formal standards have a significantly more substantial influence on (corporate) success factors than consortium or de facto standards are confirmed. In particular, companies see more advantages in aspects relating to transaction costs through use and access to the market. For example, formal standards and technical rules and specifications have a significantly greater influence than other standardization processes on ensuring legal certainty, fulfilling formal and informal market access conditions, establishing technical interoperability, and negotiating vis-à-vis suppliers and customers (see Figs. 6 and 8).

If we consider factors relating to improving internal company processes - above all quality and productivity improvements - company standards play a similarly important role. Internal plant standards have received higher approval ratings than formal standards and technical rules or specifications in productivity improvements since 2013. However, this difference has narrowed since the start of the Corona pandemic. In terms of optimizing research, development, and innovation activities, as well as competitiveness, internal factory standards have higher importance than consortium and de facto standards.

This dichotomy of assessments is consistent with the findings of an earlier survey on the macroeconomic benefits of standardization<sup>5</sup>, which also concluded that internal company standards are important for the success of internal company processes, and formal standards above all for successful operation on the market.

<sup>5</sup> DIN Deutsches Institut für Normung e. V. (2000): "Overall economic benefit of standardization: Summary of results. Scientific final report with practical examples", Berlin, Vienna, Zurich: Beuth Verlag. GERMAN STANDARDIZATION PANEL 2022 19

Figure 8

## Change in assessments of the impact of standards on success factors 2013 - 2021

Average assessment of the impact of different types of standards on success factors. -3 (very negative) to +3 (very positive). Weighted Samples 2013 - 2021, N=8,481 to 11,384.



The latest surveys indicate that formal standards and technical rules or specifications increasingly assume both functions (Figure 8).

The differences were particularly significant for the market-related functions of standards. In particular, the positive effects on ensuring legal certainty, facilitating market entry, and improving negotiating positions vis-à-vis suppliers and customers decreased (but were statistically significant) compared with the previous year. This pattern held for all types of standards. One possible interpretation is that the impact of standards was perceived to be weaker due to the sharp change in challenges during the crisis, and the global economic crisis overshadowed the importance of standards. Faced with abrupt onsets in demand and the short-term transformation of work and logistics processes, companies had to respond dynamically. New strategy changes introduced at short notice were unlikely to be able to build on standards.

In contrast to the constant assessment of the importance of standards in general, the perceived influence of standards on success factors, on the other hand, seems to have decreased since the pandemic. As Figure 8 shows, the assessments of the impact of various standards on success factors fell on average. The only exception was the influence of formal standards and technical rules/specifications on research and development or innovation activities. This suggests that companies must look for creative solutions in a crisis. As measured by both the weighted ratings and the balanced panel sample, the average ratings of the influence of standards on business success declined. This continued the trend that had begun in 2020.

In addition, the assessment of the impact of standards on success factors must be seen relative to other success factors. As other factors gained in importance during the crisis (ability to reorganize, digitization, diversification opportunities, etc.), the impact of standards may have paled somewhat in comparison. It is still striking that assessments of internal plant standards consistently fell in all categories. However, this trend is not necessarily driven by the covid-19 pandemic but may be part of a general trend. Ratings for internal plant standards had already been trending negatively over the previous eight years.

Similarly, their average importance for the secondary sector has declined almost continuously since 2013 (see Figure 9, left). Only in the area of research and development or innovation was there a slight stagnation in the values for formal standards and technical rules or specifications, presumably related to the fact that companies have to come up with creative and innovative solutions in the covid-19 crisis.



### STANDARDIZATION ACTIVITIES

While the previous question focused more on the survey of changes in activity due to the restriction of the supply of standardization, another question addressed the standardization intentions of the participants, which internal company changes could also shape (e.g., changed standardization budgets). Like all other areas of the economy and society, standardization was affected by the impact of the Corona pandemic.

Thus, in the course of the restrictions introduced in 2020 to contain the pandemic, standardization also switched to remote operation. At DIN and DKE, for example, all working committee and committee meetings were held digitally from spring 2020. Although according to the current hygiene regulations (as of May 2022), registered physical sessions are allowed under hygiene protection measures at DIN's premises, most meetings are still held digitally.

The special section of the last survey wave (2020) of the DNP shed more light on this situation. At that time, it was evident that the companies kept their standardization activities stable, welcomed the reduced expenditure through digital events, but criticized the loss of informal exchange. Therefore, to measure changes concerning these aspects, some questions from the special section in 2020 were also taken up again in the 2021 survey.



### Figure 10

Have you changed or do you plan to change your participation in standardization due to the Corona pandemic? N = 273 to 274 Compared with the 2020 survey, a larger proportion of the companies surveyed stated that they had not changed their involvement in standardization against the background of the pandemic and were not planning to do so (Figure 10, right). This proportion was 82 % (standardization) and 86 % (consortia). These figures have not changed compared with the previous year.

In addition, 12 % of the companies stated that they had increased their participation in standardization or were planning to do so (equivalent to 7 % for consortia). This represents a slight increase compared with the previous year. Furthermore, the multivariate analyses at this point revealed no significant differences concerning company characteristics. The participants' assessments show that this only slightly influenced standardization activities. Most companies (45 %) indicated that the corresponding workload in standardization had not changed compared to 2019 (Figure 10, left).

Compared to 2020, the first year of the covid-19 pandemic, 43 % indicated that the workload had not changed. Compared to 2019, 21 % of respondents in 2021 expressed that the workload had increased. In contrast to 2020, this number decreased, and only 12 % indicated an additional effort had to be undertaken. For 19 % of respondents, the effort became less compared to 2019, and 31 % of respondents perceived the effort to be the same.

### Stable standardization activity despite Corona

This overall stability in participation was reflected in activity in various standards organizations and consortia (Figure 11). Participation figures increased slightly compared to the previous year, with most participants at DIN (84 %, compared to 81 % the last year) and about half at CEN (55 %, compared to 50 % the previous year) and ISO (50 %, compared to 49 %). On the other hand, participation at ITU was down from the last year, with only 10 % of companies reporting active involvement. In 2020, the figure was still 21 %. However, the general trend toward more national and international standardization and less European standardization is being maintained.

A more substantial change was observed concerning activities in consortia. At 52 %, participation in national consortia almost returned to the pre-pandemic level of 56 % in 2019. In 2020, engagement dropped by more than half. In this year's special section, respondents were also asked to provide retrospective assessments of their activities for 2020. These do not match the information companies offered in the previous survey; retrospectively, this engagement is with 52 %, identical to the 2020 figure (which was queried in 2021).

In contrast to these stable figures, the proportion of companies active in supranational consortia decreased. This was most evident internationally, where 32 % of companies reported participating in at least one consortium, down from 54 % in 2019. The self-assessment from 2020 was 31 %. Looking at the engagement at the European level, a stabilization towards pre-pandemic levels was also observed again in the area of consortia. While participation rose to over 40 % in pre-pandemic years, it dropped to 38 % in 2021, in line with the retrospective estimate for 2020. Participation in consortia seems to have recovered from the Corona shock. Collaboration at the European level has decreased compared to the previous year.

The second core part of the DNP survey addresses companies' external and internal

standardization activities. Over 1000 company and industry representatives provided information about participation in standardization organizations at various regional levels (DIN and DKE at the national level, CEN, CENELEC, and ETSI at the European level, and ISO, IEC, and ITU at the international level). 47 % of the participants were active at the supranational level, 59 % at DIN or DKE. About 41 % of the participating companies were also represented in consortia. Compared to SMEs, large companies (>250 employees) were more strongly expressed at all levels in at least one committee of a standardization institute. While most companies surveyed participate in the standardization processes of national organizations, participation in standardization at the European and international levels is lower.

Most of the companies surveyed participate in the standardization processes of national organizations. Involvement in supranational standardization is somewhat lower. To a certain extent, this can be attributed to the system of representation of the interests of national bodies in European and international mirror bodies by individual delegates. Just under 47 % of the respondents act in national and supranational international bodies. Very large companies from the vehicle manufacturing and electrical engineering sectors, in particular, are active at all levels. Among electrical engineering companies, the proportion of such companies strongly represented in standardization was 59 % and as high as 66 % for vehicle manufacturing.

The stability of standardization activities contrasted with adverse changes in related expenditures. The direct question about the actual spending with numerical input resulted in few and unreliable answers. For this reason, we asked participants whether spending on standardization activities decreased, remained the same or increased. As Figure 12 shows, about 92 % to 97 % of organizations had increased or held constant their spending on standardization departments from 2014 to 2018. In 2020, spending increased at only 8 % of organizations, while it stagnated at 52 %, and the proportion of organizations that reduced spending grew to 40 %.

In 2021, respondents were asked about the differences in spending on standards departments between 2020, the start of the Corona pandemic, and 2019. Compared to 2019, 66 % of companies indicated that spending had increased or remained the same, while 19 % showed that spending had decreased compared to 2019. Looking back to the year the Corona pandemic began, only 55 % of respondents indicated that spending had increased or remained that spending had increased or remained that spending had increased or remained constant. In contrast, 31 % clarified that

Figure 11



Have there been any participation changes as a result of Corona? Board seats in standards organizations 2018-2021 (number of companies with respective number of seats), balanced panel (companies that provided information on this from 2018 to 2021, N=80)



### Figure 12

Change in expenditure for standardization departments N = 757 to 763

- -o-less
- ---more
- -o-no change



spending on standardization processes had decreased. Decreased expenditures combined with unchanged standardization activities could be interpreted as efficiencies associated with increased levels of digitization and reduced travel costs.

### Standardization's most important benefits: dissemination of standards and ability to influence government regulation

This year's assessments by the standardization experts confirm the findings of the previous surveys concerning the criteria that are decisive for the participation in formal standardization over consortia. Moreover, in line with the more robust involvement in formal standardization in the sample, the positive assessment of corresponding participation criteria also predominates.

The strongest arguments in favor of standardization for the companies conti-

### Figure 13

Assessment of the extent to which different criteria influence participation in consortia and standardization bodies Change in assessments from 2017 to 2021. Scale= -2 (rather consortia) - +2 (more likely to be standardization). N = 4,879 to 5,143 Formal standardization vs. standardization in consortia



nue to be the high level of dissemination and the great influence of formal standards (Figure 13). The highest-rated criterion for participation in standardization is the high number of users of formal standards. This is followed in second and third place by the type of user of these standards and the influence on government regulation made possible. Also clearly in favor of activity in standards, organizations were contacted with other participants, as well as positive experience and regulations on patents (such as licensing conditions for standard-essential patents). The reputation of committees and copyrights, as well as the other participants and their know-how, also tend to speak in favor of standardization.

On average, two criteria have been seen in all surveys so far as advantages for standardization in consortia: Faster processes and lower document costs. Even though the cost aspect in consortia is rated as a major advantage by a large proportion of respondents, a large group assigns a slight rating advantage for standardization on this point. The same applies to the aspect of the speed of processes. The standardization bodies appear inferior to the consortia on these points, but the processes are not to be rated exclusively negatively either.

Although the companies' cost aspect is assessed more positively for consortia, the standardization bodies receive a more positive assessment for the criterion of personnel costs. The issue of participation costs, in particular, was evaluated as a positive effect of the Corona crisis this year and last year, promoted by increasing digitization. Nevertheless, it can be observed that the cost aspect has lost approval compared to the previous years. Main criteria in favor of consortia, such as speed of processes, and those in favor of standardization, such as number and types of users and influence on government regulation, have become more and more aligned since 2016. However, this year, a further decline in the more positive ratings of formal standardization versus consortia could not be confirmed. Instead, the differentiating criteria are consolidating, as shown.

### MANAGEMENT SYSTEM CERTIFICATION

### More certifications according to ISO 14001

As in the previous surveys, the participants provided information on whether they received certification according to specific formal standards during the last year of the survey (2020). If this was the case, they were further asked to indicate in which year the initial certification took place. In total, between 1475 and 1729 companies provided information on these questions.



Many companies reported having certified at least one of the significant quality, environmental, energy, or IT security management system standards in 2020 (see Figure 14). This corresponds to the values from previous years. The quality management system standard ISO 9001 was the most widespread, with 68 % of companies certified. In addition, 42 % of companies reported having an environmental management system certified to ISO 14001; this was also where most planned new certifications were recorded, at 6 %. The certification that has grown the most recently was that of energy management systems to ISO 50001, which stood at 25 % in 2020, a slightly flattened figure compared to initial certifications in previous years. ISO/IEC 27001 related to IT security management was implemented in 18 % of participating companies in this year's sample. Nearly half of the companies (48 %) have not yet been certified to ISO/IEC 27001. However, 5 % have plans to do so. As expected, larger companies had a significantly higher proportion of certifications.

The biggest difference was in IT security management. Less than 10 % of small and medium-sized companies were certified to ISO/IEC 27001. Certification to ISO 14001 and, in particular, ISO 50001 was equally rare among small companies, while 15 % of medium-sized companies were certified to these standards. Quality management system certifications to ISO 9001 were somewhat more prevalent among small companies, accounting for 13 % of the total. The figure for medium-sized

### Figure 14

Proportion of certified companies in 2021 according to various standards N = 638 to 745 companies was around 25 %, a decline compared with previous years. Innovative companies were also more frequently certified - particularly to ISO/IEC 27001. Companies that were certified to ISO 50001 are also particularly active in the area of internal research and development work and product innovations.

## Certification to ISO/IEC 27001 still more relevant for large companies, ICT and vehicle construction

Companies from the electrical engineering, plant and mechanical engineering, chemical and pharmaceutical industries, vehicle construction, and metal industry in particular generally took advantage of the opportunities for certification. At the same time, this was much less the case for service companies. The certification of a management system for information security could be observed above all in the electrical engineering and vehicle construction industries. Interestingly, this year the shares of individual certifications for individual industries are much lower than in previous years.

Just under 450 companies provided information on certification following other types of management system standards. As in the previous year, the largest share (n = 132) was accounted for by testing and calibration laboratories and certification bodies certified to ISO/IEC 17025, ISO/IEC 17065, or ISO/IEC 17020. On the other hand, industry-specific quality management systems, especially in the field of medical devices (ISO 13485, n = 47) and certifications of occupational health and safety management systems according to ISO 45001 (formerly OHSAS 18001) (n = 45), played an important role.

## IMPACT OF THE COVID-19 PANDEMIC ON STANDARDIZATION

To continue to monitor the effects of the covid-19 pandemic, the 2021 German Standardization Panel survey was again asked some questions from the 2020 survey. In 2021, society and the economy continued to be affected by the impact of the covid-19 pandemic. For example, another lockdown took place in the spring of 2021, the recommendation to work in a home office continued to apply, and supply chains were disrupted. Companies were therefore affected by material shortages but also by staff shortages.

### Figure 15

Percentage of responding companies (2021) and unweighted mean values in 2020 and 2021. N = 3,538 to 3,595.. Which of the following has been the negative impact of the Corona pandemic for your company so far? Closing of business Closure Personnel Demand .ogistics .iquidity **Material** Temp. 0% 4 18% 21% 4 (strongly 37% 41% applies) 25% 3 54% 56% 3 2 88% 2,04 50% 2 1 1,70 0 (does not 1,35 1,31 apply) 0,95 0,85 avg 2020 75% 1 avg 2021 0,22 100%

## Personnel bottlenecks and material shortages overtake decline in demand

The companies participating in the survey continued to be significantly affected by the pandemic, but to a lesser extent than in the previous year and other aspects. The survey highlighted that 59% of companies experienced losses due to declines in demand or the cancellation of existing orders, an improvement from the previous year when over 70% experienced declines in demand. In this year's survey, companies were more frequently affected by staff shortages due to illness, quarantine, or childcare (see Figure 15). In addition, 82% said they were restricted.

As a result, a slight increase in the previous year. Another rising factor this year was the hindrance of production and sales either due to more difficult access to raw materials or precursors or impacts on logistics, e.g., in the distribution of products to customers. In contrast, only a small proportion of respondents (12%) said they had been affected by complete business closures, a marginal difference from the previous year. It is unclear at this point whether the decline

in companies affected by closures can be explained by the fact that they no longer took part in the survey due to the closure of their business (selection bias).

A comparison of the effects, taking into account different company characteristics simultaneously, showed that the vehicle manufacturing, chemicals and pharmaceuticals, and mechanical and plant engineering sectors were most severely affected in most categories. The secondary industry was more affected by material shortages and logistical difficulties. On the other hand, the construction industry was significantly less affected by declines in demand, closures, and liquidity problems, than in the previous year. In contrast, companies in the services industry were significantly less likely to report problems with material flow, logistics, and personnel. Consumer goods manufacturers and the electrical engineering sector suffered particularly from material bottlenecks. Very large companies (+1000 employees) were affected significantly more often by logistics problems and closures, as in the previous year. Both very large, large but also medium-sized companies were more affected by material shortages or logistical difficulties than smaller companies. Last year, this difference also applied to staff shortages. At this point, the values between the different company sizes converged.

Figure 15 shows that the impact of the pandemic on standardized companies differs from the previous year in the aspects of demand, personnel, and logistics. The dynamics of the crisis can explain apparent differences in these aspects. While companies in the previous year were even more affected by the slump in demand, which was particularly noticeable at the beginning of the crisis, the situation stabilized slightly in 2021. At the same time, it became apparent that personnel problems mainly were assessed as even more severe in 2021 due to factors such as the further spread of the covid-19 virus, quarantine, or childcare. The same applies to logistical problems, which increased due to the negative impact on the global economic chain.

## Participation simplified, but informal exchanges are lacking

While the digitized standardization processes introduced due to the covid-19 pandemic had a cost-reducing effect (60% welcomed this impact) and simplified the participation of new stakeholders, there was also criticism of the implementation. For example, some perceived lower quality of the standardization process and the resulting standards due to the digital formats. Half of the respondents cited the lack of informal exchange as a critical reason for this. This information stands out because, even after a year of hybrid work and the changeover, there has been no improvement here, but rather a deterioration (falling mean value compared with the previous year), and standardization was attested to have suffered a slight overall loss of quality.

Thus, the assessment for the aspects of quality of the exchange of content, the process as a whole, and the results, as well as consensus findings, were predominantly negative and, on average, more negative than in the previous year. Discussion and consensus-building processes are often based on informal and face-to-face interaction that facilitates the exchange of complex knowledge.

From this point of view, digital channels can reduce the capacity of information transfer and thus make consensus-building more difficult. On the other hand, digital meetings also help reduce information asymmetries within committees and between committees and external stakeholders. Easier access to standardization, mainly through reduced travel and thus time and cost, can increase the number of participants and diversity and thus further enhance the quality and legitimacy of standards. As in other areas of society, changed forms of work in standardization must be further optimized. A key aspect is to strike a balance

Do corona-related changes have positive or negative impact on the standardization process?

N = 1,279 to 1,287, mean values: weighted random samples, N excluding "other"



**Figure 16** 



+2 (strongly

between the efficiency gains from digitization and the benefits of personal, informal exchange (see Fig. 16).

### Summary

Standardization remains stable during the covid-19 pandemic. A very high proportion of companies reported that they had neither reduced nor planned to reduce standardization activities due to the pandemic (see Figure 10). As with the relatively stable activity levels, there is no significant decrease in spending on standardization activities after a dip from the previous year (see Figure 12). Standardization efforts are sustained along with stable activity levels and expressed intentions. One explanation could be the costs saved through digitization.

While the overall perception of the importance of standards remained essentially unchanged, the (perceived) influence on success factors continued to decrease slightly, as in the first year of the covid-19 pandemic (see Figure 8). This can be interpreted as a change in relative influence, as other factors for corporate success dominated over norm-related aspects during the crisis. For the success factor "research and development" alone, a slight improvement in the values for formal standards and technical specifications was observed. In 2021, most companies were primarily affected by personnel and material shortages due to the Corona pandemic. In 2020, they had to contend in particular with declines in demand. Although the digitization of the standardization processes meant that the reduction in costs was seen as positive, there was also criticism. In some cases, the quality of the standardization process and the resulting standards was perceived lower than in non-digital processes. In the second year of the covid-19 pandemic, the lack of informal exchange was also cited as a primary reason (see Fig. 16).

## STANDARDS, STANDARDIZATION AND CLIMATE CHANGE

Standards result from joint efforts by stakeholders from industry, science, government, and society, to create rules that ensure the interoperability of products and guarantee quality and safety for the user. They can also be used to improve environmental protection. For example, standards can help spread the voluntary implementation of climate-friendly rules in industry and society. Adaptation processes in standardization must be proactively considered in standards to address possible consequences of climate change at an early stage. The review of standards concerning the consideration of climate impacts is, therefore, for example, also a component of the German Strategy for Adaptation to Climate Change<sup>6</sup>.

This topic has already been present among standards organizations for some time. Environmental protection representatives have been explicitly involved in the standardization process since the 1990s, at DIN, for example, through the Coordination Office for Environmental Protection (DIN-KU) or the DIN Standardization Committee on the Principles of Environmental Protection (NA-GUS). Environmental topics can thus be considered in standards, especially as standards makers find support in special guides and aids. At the international level, the ISO London Declaration provides an explicit commitment by standards organizations and the resulting standards to mitigating climate change<sup>7</sup>.

But are standards already fulfilling their full potential in mitigating and adapting to climate change? How vital is the role of standardization here? What aspects of the standardization process can potentially be improved to address climate change further? In the special section of the survey of the German Standardization Panel 2021, these questions were put to standardization experts. Within the questionnaire, the importance of climate change for companies was addressed in more detail, as well as the areas in which standards are considered to have a particular influence on mitigating and managing it. Furthermore, the respondents were asked to indicate to what extent standards and the standardization process still need to be optimized to exploit their full potential. Finally, respondents had the opportunity to rate measures, materials, and contacts that already support the implementation of more climate-friendly standardization. A question on the relevance of the United Nations' Sustainable Development Goals, or SDGs, addressed a question from the special section of the 2019 German Standardardization Panel.

### The United Nations Sustainable Development Goals

For the second time, the German Standardardization Panel is examining the corporate perspective on the topic of standards and sustainability goals. As in 2019, the relevance of the Sustainability Goals for standard-setting companies was queried. To this end, the 959 participants selected five goals that were most relevant to their company or industry and placed them in ranks one to five according

<sup>&</sup>lt;sup>6</sup> ISO International Standardizazion Organisation (2021): "The London Declaration," available at: https://www.iso.org/ClimateAction/LondonDeclaration.html

<sup>&</sup>lt;sup>7</sup> AUBA Federal Environmental Agency (2018): "Climate Change Adaptation," available at: https:// www.umweltbundesamt.de/themen/klima-energie/klimafolgen-anpassung/anpassung-an-den-klimawandel-0#was-heisst-anpassung-an-den-klimawandel



to their importance. Relevant was defined as those objectives to which the company or industry makes a particular contribution or which have a specific impact on changes there in general. This part was repeated as part of the special section on standards, standardization, and climate change in 2021, with 1551 participants.

The 17 Sustainable Development Goals (SDGs) were adopted by the United Nations member states in 2012 and are intended to help pursue sustainable development at the economic, ecological, and social levels. Their implementation is scheduled for 15 years, from 2016 to 2030. Through the standardization process, companies can agree on rules that keep pace with technical developments but also take into account strategic objectives that may go beyond the goals of individual companies. When sustainability goals are specifically addressed, standards can influence the sustainability of entire industries at regional to international levels. In 2019, ISO began classifying standards by their affiliation with the SDGs. As of May 2021, for example, the 9th goal ("Industry, innovation and infrastructure") has 13137 ISO standards assigned to it, and Goal 3, "Health and well-being," has 3070. On the other hand, goal 13, "Climate action," has only 1177 ISO standards assigned to it so far.

### SDG 13: "Climate action" in first place this year

The Sustainability Goal "Climate Action" ranked first in the ratings this year, with 263 participants placing it first, representing 17 % of the respondents. In 2019, this goal was still in third place among the goals relevant to standard-setting stakeholders. "Health and well-being" (SDG 3) was ranked second only by 240 companies (15 %), and SDG 9, "Industry, innovation and infrastructure," (12 %) landed in third place. These last two items were reversed in the 2019 survey and were represented in the first two positions (SDG 9 in first place and SDG 3 in second place). SDG 13, "Climate action," landed in third place then.

The prioritization of the goals revealed expected industry-specific differences. For example, the metal industry, in particular, selected the goal "Industry, innovation and infrastructure" in the first place. For the mechanical and plant engineering sectors, which chose this goal in first place last year, goal 13, "Measures for climate protection", now plays a more critical role. "Health and well-being" was the most crucial sustainability goal for companies in the medical technology and optics sectors. The most minor selected goals overall were "Less inequality," Life on land," "Life under water," "Peace, justice, and strong institutions," and "No hunger". This coincided with the tendency of companies to see their contribution more in economic-technical areas related to climate change than in social issues.

Comparing the relevance of the goals with the number of international standards assigned to them by ISO, a harmonious picture emerged in 2019. The mapping clearly shows that the focus of international standardization is mainly on the industry, innovation and infrastructure, and health and well-being. This is congruent with the main objectives of standards, establishing technical interoperability and product safety, and the assignment of importance for respondents in 2019.

## Climate change even more relevant in the future than now

In response to the question of how relevant climate change is for the respective company now and in the future, it became clear that climate change is already perceived as very relevant overall: 68 % of the standardization experts agreed with this at this point. Looking at the topic's relevance in the future, this agreement on



### Figure 18

How relevant is climate change NOW and IN FUTURE to your company? Top: Total. Bottom: By industry, mean values. N = 776 to 1,862. the importance was reinforced once again. Almost 90 % of the respondents stated that the matter would be relevant to very relevant in the future (see Fig. 18). It is considered very relevant by 50 % of respondents. This finding is confirmed across the different sizes of companies and industries. The energy sector and vehicle manufacturing show clearer approval. They are already dealing with the consequences. The information and communications sector, medical technology, and optics have the lowest approval ratings.

The survey also asked how the influence of various aspects on climate change is assessed. The respondents had to evaluate the influence of their own company or sector, the effect of nouns relevant to the industry, and the influence of the legal framework in this respect. More than 50 % of the respondents attributed a positive influence on climate change to all three aspects. For the respondents, the influence of standards exceeds that of their own company or industry. That legal framework conditions influence climate change was agreed to by 75 %. This value thus exceeds the estimated relevance attributed to the respondents' industry and the standards relevant to their industry (see Figure 19).

These results are confirmed across all sectors. Only other services contradict this pattern. It appears that the influence this industry attributes to its own companies or industry is equal to the influence of the legal framework. The influence of its industry outweighs the influence of standards relevant to the industry. The information and communications and construction sectors rate the influence of the legal framework particularly highly.

### Can climate change be addressed through standardization?

Furthermore, it was to be determined whether, in the view of the standardization experts, climate change can be addressed through standardization. The results allow a conclusion to be drawn as to the extent of the contribution already realized that standards make to support the adaption or mitigation of climate change. Furthermore, it should be assessed how great the potential is with which standards, in the respondents' opinion, already support the fight against or the management of climate change. Finally, it was also possible to determine more precisely the extent to which climate change is already addressed in standardization.

#### Mitigation

Standards contribute to mitigating climate change, for example, when they spread the voluntary implementation of climate-friendly rules in industry and society.

#### Adaption

Standards need to respond to changing requirements due to climate change. Adaptation processes must be taken into account proactively in standards in order to be able to address possible consequences of climate change at an early stage. It becomes clear that all types of standards already enjoy a high level of approval regarding the already realized contribution they can make to both adapting to and mitigating climate change (see fig. 20). At the same time, the potential exceeds this value. This agreement on the importance of the potential to address climate change is particularly valid for standards referenced by legislation and for international standards. Consortia standards received the lowest level of agreement about mitigating and adapting climate change. Figure 20 makes it clear that, from the respondents' point of view, standards are already making a contribution to adapting and mitigating climate change. At the same time, however, it is clear that the potential that standards could bring to this process has not yet been exhausted.

### **Reactions still too slow**

To gauge the extent to which climate change is currently taken into account by standards, the participants in the survey rated various statements on this topic. The statement that "the response to climate change through new standards or re-

### Figure 19

How do you estimate the influence of ... on climate change? Scale: -3 = very negative +3 = very positive. N= 1,511 - 1,513



vised standards is too slow" received the most agreement (75 %). The following two statements, "Climate-relevant regulations in standards are not specific enough" and "Standards do not sufficiently take into account changing climate data (average temperatures, climate zones, etc.)" were confirmed by 60 % of the respondents (see Figure 21). The statement that "climate change impacts are generally not taken into account by standards" received agreement from about half of the experts. That "standards are often contradictory concerning climate change" could only be confirmed by about one-third of the respondents. Here, over half voted for the neutral option. The results suggest that standardization texts are still too vague in many places and that the relevant climate data are not considered. In addition, adjustments take too long. Overall, the general consideration of the topic of climate change in standardization is missed by more than half of the participants. The participants do not confirm that standards are too contradictory regarding climate change.

Other aspects mentioned by the respondents before this context were formulatet as free text under the element "Other". Those statements showed that standards addressing the measurability of sustainability are too complicated for most users and that some standards are outdated (here, for examp-



### Figure 20

Potential and already realized contribution of norms and standards to combating and managing climate change.

-3 (not at all; corresponds to 0) to +3 (very much, corresponds to 7), N=1,418 to 1,497

#### Potential

To what extent could norms or standards in your opinion potentially contribute to in mitigating/managing climate change?

#### **Realized Contribution**

In your opinion, how much do standards in your opinion already support in adapting to / mitigating the consequences of climate change? le, concerning EN 1307 on colorfastness) and that specifications on climate protection are not even mentioned. Further points of criticism at this point were inadequate monitoring of applied certifications at home and abroad, and that political institution blocked each other concerning standardization.

When examining the response behavior according to the individual sectors for this question, all sectors agree that the responses to climate change in standardization are too slow. At the same time, there is cross-industry disagreement about whether climate data are sufficiently taken into account, whether climate change impacts would generally not be taken into account, and whether standards are often too contradictory concerning climate change. In particular, the information and communication sector has a dissenting position on the statement regarding inconsistency.

Other services state that standards do not consider changing climate data and that climate change impacts are generally not considered by standards much more negatively than the rest of the industries. This suggests that the sector of other services already considers climate change impacts and climate data more than other sectors. Agreement with the statements that climate-related regulations are still too vague and that climate data are not sufficiently taken into account is higher in the construction sector than in other sectors. There appear to be large gaps in standardization texts in this sector about the consideration of climate change.

## More international coordination and exchange with science

In a further question, the respondents had the opportunity to evaluate the measures, which mainly contribute to a better consideration of climate change in standardization. As Figure 22 shows, in this case, the aspects "More knowledge exchange with research", "More international coordination or a more internationally uniform agenda" and "More coordination between legislators and standardization organizations in this respect" in particular registered high levels of agreement. On the other hand, the measures with the lowest level of agreement on this question were "Better integration of relevant stakeholders in the standardization process (e.g., environmental associations, climate researchers)", "More supporting material and framework



### Figure 21

To what extent do you agree with the following statements?

Formal standards will have to deal more with climate change and its consequences

#### in the future.

The topic of climate change should be **proactively** addressed by standardization experts and standardization organizations.

The requirements for combating and coping with the consequences of climate change must come from **society and politics.** 

The issue of climate change is already **sufficiently addressed** by existing standards.

Standards represent the state of the art and therefore **cannot address** an issue such as climate change. conditions (e.g., guides, databases, related standards such as DIN SPEC 35220)" and "Explicit self-commitment by standards developers to sufficiently consider aspects relating to climate change in standards". The low level of agreement with the statement that more supporting materials are not needed is exciting, as it becomes apparent in the next question that most respondents are unfamiliar with the materials.

Differentiated by industry, it appears that agreement with more exchange with research comes primarily from the energy, electrical engineering, chemical and pharmaceutical, and professional, scientific services industries. It is also striking that the metal industry has meager approval ratings for all proposed measures. The information and communications, medical technology, and optics sectors have the lowest confidence level in the "voluntary commitment" measure.

### Supporting materials often not known

To find out in more detail how companies approach the issue of standards and climate change, they were asked about supporting materials in national and international standardization. In national standardization, for example, DIN SPEC 35202, a guide to incorporating climate change adaptation into standards, is considered a helpful manual. In international standardization, ISO Guide 64 can assess environmental aspects in product standards. Furthermore, respondents were asked to indicate whether they had already contacted contacts in national or international standardization on the subject of climate protection standardization. In Germany, for example, these are the DIN Coordination Office for Environmental Protection (DIN/ KU) or the DIN Standards Committee on the Fundamentals of Environmental Protection (NAGUS); at the international level, the Strategic Advisory Group on the Environment (SABE) and the Adaptation to Climate Change Coordination Group (ACC-CG) at ISO and, at CEN and CENELEC, the Task Force on Climate Change are available as contacts.

It was asked to indicate whether the tools and contacts have already been used or contacted in the standardization process, whether they are known but ne-

Which measures in particular can contribute to a better consideration

N= 405 - 1,400 3 totally agree Coord. Science Legislati Int More 2 Coord. Legal support Climate Coordination on Monitoring Considerat. SS0s Requiem SS0s data Stakeholder Self-Material C Commitment O 0 neutral Science More exchange with the scientific community Coord. SSOs More exchange / coordination between standardization bodies Intl. More related support for standards developers through More support More international coordination/ more homogenous int. agenda Coordination coordinating bodies in standards org. ("climate helpdesk"). by SSOs Coord. More coordination in this regard btw. Legislators and SSOs Better account for changing climate data (e.g., average Legislation Climate data temperatures, climate zones) Regular examination of standards for need of adaptation Monitoring Better integration of relev, stakeholders in standardization due to CC Stakeholder process (e.g., environmental associations, climate researchers) Legal More legal requirements for climate-relevant rules, which can Requirem. More supporting material and frameworks (guides, databases, then be taken into account in standards Material related standards (e.g., DIN SPEC 35220) More frequent, concrete consideration of CC impacts in relevant Consideration Self-Explicit self-commitment of the standards developers to take standards (e.g., an extra section on this topic) Commitment sufficient account of aspects relating to CC in standards

climate change in standards?

Figure 22

ver used, or whether they are unknown. The analysis of the responses makes it clear that half of the respondents are unfamiliar with the materials or contacts (see Figure 23). One-third of each did not refer to them even though they were known. For all types of materials, 10 % said they had already used them, and between 15 % and 18 % had already had contact with contacts at the national and international levels. Looking at the industries, it can be seen that the metal industry, electrical engineering, and consumer goods manufacturers contacted international contacts more than other industries. On the other hand, the companies in medical technology and optics and information and communication

### Figure 23

Are you familiar with the following supporting materials or contact persons related to standards and climate change? In the standardization process, have you already made use of them or sought contact? N = 1,402 - 1,405



most frequently stated that they did not know the materials and contact persons.

### CONCLUSION

### Key findings from the tenth survey of the German Standardization Panel

Considering burdens caused by the Corona crisis, the standardizing companies are mainly affected by staff shortages and material and logistical bottlenecks in the year. Compared with the previous year, there is a shift toward more personnel and material/logistics problems and less decline in demand. This reflects the expansion of the Corona crisis as a burden on the global economy. Participation in formal standardization had returned to pre-pandemic 2019 levels compared to 2020. There has been a repeated shift from national to international consortia and less to European consortia. The latter could be related to minor differences in participation costs between national and international consortia, e.g., due to travel recruitment.

While the overall perception of the importance of standards remained essentially unchanged, the (perceived) influence on success factors decreased slightly, as in the previous year. This can be interpreted as a change in relative influence, as other factors for corporate success, such as material bottlenecks, logistical difficulties, and personnel availability, dominate over standards-related factors during the crisis. The significance of the research and development success factor alone increased slightly.

The workload for standards development remained essentially constant at most companies. Compared to 2019, it even increased in some cases. A very high proportion stated that they had neither reduced their standardization activities nor planned to do so due to the pandemic. These numbers were somewhat lower when explicitly asked about perceived changes in the level of participation, the output of new/adapted standards, and the number of new topics, especially about workload. Then, there was a difference between companies' motivation to be active in standardization and the extent to which they could realize their activities. Restrictions on standardization activities were possibly caused more by regulations and new rules in the standardization process than by constraints on the company side.

After the slump from the previous year, there does not seem to be a significant decrease in spending on standardization activities and commitment to standardization activities. In the past survey, companies indicated that 40% of organizations had reduced their budgets for dedicated standardization departments in 2020. However, this contribution was retrospectively reduced to 30% in 2021. One explanation could be the costs saved through digitization. These little reduced expenditures, together with the stable activity levels and the expressed intentions to maintain them, show that standardization is not as affected by the covid-19 crisis as noted in the previous year.

In the previous year's survey, it was noted that digitized processes had a cost-reducing effect and simplified the participation of new players. At the same time, it was already apparent there that the digital standardization formats and their results were perceived as lower quality. This could be confirmed this year. The lack of informal exchange was mostly cited as a central reason for this. In particular, it became apparent that even after a year of hybrid work and the long-term switch to digital methods, there has been no improvement here but rather a deterioration. As in other areas of socie-

ty, changed forms of work must be further optimized in standardization. A key aspect here is to strike a balance between the efficiency gains from digitization and the benefits of personal, informal exchange, such as hybrid approaches fundamentally enable.

Climate protection measures are seen as the most critical sustainability objective by the participants in the standardization panel. This is because the results of the special section show that climate change is already seen as relevant by the vast majority and will become even more critical in the future. Although the legal framework is more important for climate change, standards are already essential. Standards are already contributing to mitigating and adapting climate change and its consequences, but their potential has not yet been exhausted. Here, international standards or standards related to legal regulations play the most crucial role.

In the future, however, the issue must be addressed more comprehensively and proactively. In contrast to most other areas of standardization, the specifications relating to mitigating and adapting the consequences of climate change must come from society and politics. Furthermore, the approach must be faster and more concrete. Finally, standardization can address climate change more effectively through a more intensive exchange of knowledge with the research community, better international coordination, and even closer coordination with legislators. However, existing materials and contacts to support the implementation of climate protection measures are still unknown to more than half of the respondents. Finally, approaches like the German Standardization Panel as a transdisciplinary project can contribute to the development of climate-friendly standardization.

### SURVEY DETAILS

The German Standardization Panel is conducted by the Department of Innovation Economics at the Technical University of Berlin (TU Berlin) and is financed and supported by DIN and DKE.

To present representative results for the companies involved in standardization, the survey results are being compared to DIN's data on companies active in standardization. Furthermore, in the medium term, data from the innovation surveys commissioned by the German Federal Ministry of Education and Research since the 1990s and from the study on the research and development of economic statistics by the "Stifterverband für die Deutsche Wirtschaft" are being used to complete the picture.

For the subsequent surveys, it will be essential to motivate previous participants to participate in the following survey waves to establish a helpful panel structure. Finally, other businesses will need to be encouraged to participate in further surveys to gain a broader, more representative database.

### **Catalogue of questions**

The goal of the German Standardization Panel is to measure not only the expenses and effort of companies investing in standardization, i.e., the activities in standards organizations but also their utilization of the results of this work, that is, the application and implementation of standards and specifications. The questionnaire was divided into four sections:

- 1. Importance of formal and informal standards and specifications
- 2. Standardization and sustainability goals
- 3. Standardization in trade with China/USA
- 4. Formal and informal standardization activities
- 5. General information

The complete questionnaires of all surveys since 2012 can be downloaded from the DNP website: normungspanel.de

### GLOSSARY

Formal standardization	In Germany, "formal" national standardization (also called "full consensus standar- dization") is defined as the "systematic unification of material and immaterial sub- jects carried out by all stakeholders working in consensus for the benefit of society as a whole" (see <i>DIN 820-1:2014-06 Standardization – Part 1: Principles, definition</i> <i>from DIN 820-3:2014-06</i> ). Provisions are laid down with full consensus and are ad- opted by recognized formal standards institutes (such as DIN German Institute for Standardization and DKE German Commission for Electrical, Electronic & Informa- tion Technologies of DIN and VDE). Formal standardization has a high level of legiti- mation due to its well-established processes.
	In addition, the international and European standards organizations form a net- work of national standards institutes. DIN's staff administer international andEu- ropean standardization activities carried out in Germany, ensuring that all rules of procedures and guidelines are complied with. They prepare, carry out and follow up meetings of international and European bodies and of the corresponding German "mirror" committees (see www.din.de).
Informal standardization	In Germany, a differentiation is made between "Normung" ("formal", full consensus standardization) and "Standardisierung" ("informal" standardization that is not ba- sed on full consensus). The latter process results in specifications, such as the "DIN SPEC", or consortia standards, for example. Usually these are developed by a tempo- rary body or standardization consortium. Full consensus and the involvement of all stakeholders are not required.
National standards organizations	<b>DIN, the German Institute for Standardization</b> , is a privately organized provider of services related to standardization and the development of specifications. By agreement with the German Federal Government, DIN is the acknowledged national standards body representing German interests at all levels, including the European and international standards organizations. DIN's purpose is to encourage, organize, steer and moderate standardization and specification activities in systematic and transparent procedures for the benefit of society as a whole and while safeguarding the public interest. DIN publishes its work results and encourages their implemen- tation. Some 30,000 experts contribute their skills and experience to the standardi- zation process, which is coordinated by 400 DIN employees (for further information see www.din.de).
	The <b>DKE German Commission for Electrical, Electronic &amp; Information Techno-</b> <i>logies</i> of DIN and VDE is a modern, non-profit service organization whichensures that electricity is generated, distributed and used in a safe and rational manner, the reby serving the good of the community at large. DKE is the Germannational organization responsible for developing standards and safety specifications in electrical engineering, electronics and information technology. Its workresults form an integral part of the collection of German standards. VDE specifications also form the VDE

Specifications Code of safety standards (see www.dke.de).

### European standards organizations

IIn Europe, standards are drawn up by the three officially acknowledged Europeanstandards organizations: the European Committee for Standardization (CEN), the European Committee for Electrotechnical Standardization (CENELEC) and the European Telecommunications Standards Institute (ETSI). The national standards bodies of CEN and CENELEC's 33 members work together to draw up European standards, which are adopted by the members at the national level (see *http://www. cencenelec.eu/aboutus/Pages/default.aspx*).

Each country is represented within Cen and CENELEC by one member body. Germaninterests are represented by DIN within CEN and by the DKE at CENELEC. Each DIN standards committee decides on active participation at the European level. This work is supported by a working committee designated as the "mirror committee" to the relevant European body. This committee determines the German position on a particular subject and sends delegates to the European committees to represent this position and participate in the consensus-building process.

ETSI is responsible for drawing up globally applied standards for the information and communications technology (ICT) industry. This includes television and radio technologies as well as the internet and telecommunications. The European Union has officially recognized ETSI as a European standards organization (see www.etsi. org/about).



International standards organizations ISO International Organization for Standardization and IEC International Electrotechnical Commission are private organizations whose members are the national standards organizations. The secretariats of ISO and IEC technical com-

mittees are held by these member organizations, who come from all over the world. DIN's standards committees decide on active participation at the international level and on the adoption of an international standard as a national standard. The main bodies of ISO and IEC are the respective general assemblies; other bodies include policy-making bodies such as the council and technical executive committees, such as the Technical Management Board. Standards work is carried out by national delegations and their experts acting in technical committees, sub-committees and working groups.

Another international body that sets rules is the **ITU International Telecommunication Union**. The ITU is a subsidiary organization of the United Nations, and is based in Geneva, Switzerland. Recommendations of the ITU are developed by government representatives of the 191 member countries and representatives of companies and regional and national organizations. They serve as guideline for legislators and companies in the member countries.

**Formal standards** In Germany, formal standards are developed by the standards committees in DIN and DKE with the full consensus of all stakeholders, and are largely recommendatory in nature. However, if they are cited in a law or contract, their use may become mandatory. They "provide, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at achieving the optimum degree of order in a given context" (definition as in *DIN EN 45020:2006 Standardization and related activities – General vocabulary (ISO/IEC Guide 2:2004))*. Standards define the state of the art at the time of their publication, and contain recommended properties, test methods, safety requirements or dimensions, for example (see www.din.de).

### The most important designations for standards:

- DIN National German Standard
- DIN VDE National electrotechnical German Standards containing safety-relevant or EMV-specific provisions
- DIN ISO, DIN IEC, DIN ISO/IEC German translation of an International Standard published by ISO and/or IEC and adopted, unchanged (but sometimes with national elements such as National foreword or National footnote), as a German standard
- **DIN EN** Official German version of a European standard. All Europeans standards are to be adopted, unchanged, by the members of the European standards organizations CEN/CENELEC/ETSI
- **DIN EN ISO** Official German version of a European standard which is the unchanged adoption of an International Standard

### Specification (e.g. DIN SPEC)

In Germany, a "specification" such as the "DIN SPEC" is the result of an "informal" standardization process, and describes products, systems or services by defining characteristics and laying down requirements. Like standards, such specifications are developed by experts in formal standards organizations such as DIN. However, they differ from formal standards in that full consensus and the involvement of all stakeholders are not required.

Consortia standards	Like specifications, consortia standards are drawn up in an "informal" standardi- zation process. They are developed on the basis of majority decision by a selected group of companies and organizations taking the form of a "consortium".
De-facto standards	De-facto standards are not developed by specific consortium, but are a consequence of market demand. De-facto standards are also known as "industry standards" and are developed in what is called an "informal" standardization process. All standards drawn up by industrial interest groups are de-facto standards.
Technical rules	Technical associations actively participate in DIN's standards committees in order to represent the interests of their members at the national, European and interna- tional level. Some of these associations also draw up their own technical rules (see <i>www.din.de</i> ), which contain recommendations on how to comply with legislation, a regulation or an established technical procedure. Although they are not legal docu- ments in themselves, they can become legally binding where cited in a law or regula- tion, for example in building regulations. Technical rules published by organizations such as VDI, VDMA, VDE are not drawn up with full consensus.
Company standards	Company standards are developed and adopted by companies themselves and or by cooperating businesses (e.g. suppliers). For example, their use can be mandatory for a company's suppliers.
Panel survey	A panel survey is a survey carried out among the same economic players (persons or companies) on the same topic and over time.



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