

EFFECTS OF COVID19 PANDEMIC ON R&D FUNDING SCHEMES IN GERMANY – FIRST RESULTS OF A COMPARATIVE ANALYSIS OF EMPIRICAL DATA

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ABSTRACT

In 2020 and 2021, practically all areas of work and life were under the influence of the Corona pandemic. In the course of 2020, it was already apparent that the consequences of the Corona crisis would also have a considerable impact on grant recipients and their projects and thus on the implementation and goal achievement of the funding programmes, and that this would be reflected in the results of evaluations. From the perspective of an evaluation of innovation funding programmes, the Corona pandemic represents an external influencing factor that could negatively affect the intended impact of a funding programme with regard to the successful implementation of innovation projects and behavioural change of actors towards innovation orientation. This article provides initial answers to the questions of what effects the Corona pandemic has on innovation promotion, what adaptation strategies can be observed and how these can be provisionally evaluated. For this purpose, the authors of this paper draw on current, as yet unpublished data from evaluation surveys in 2020 and 2021.

1 INTRODUCTION

In 2020 and 2021, practically all areas of work and life were under the influence of the Corona pandemic. The effects on society, the economy, teaching, research and administration were and are enormous. With regard to innovations, there are signs of an ambivalent development. On the one hand, numerous innovations were triggered and there was a significant surge in digitalisation, but on the other hand, innovation processes were also slowed down, and many central innovation processes promoted within the framework of innovation funding programmes were inhibited.

In the course of 2020, it already became apparent that the consequences of the Corona crisis would also have a considerable impact on funding recipients and their projects, and thus on the implementation and goal achievement of the funding programmes, and that this would be reflected in the results of evaluations (Kerlen 2020).

For many actors in research projects, the situation was very challenging because, for example, access to laboratories was temporarily restricted or no longer possible due to a lack of staff, interrupted supply chains,

meetings cancelled, conferences not held, funding diverted to corona measures, lack of technical equipment for communication, etc. Due to the consequences for individual sectors and the mostly difficult financial situation of the municipalities, it became apparent that technology policy goals of innovation promotion could no longer be achieved in all cases.

For the evaluation of research, technology and innovation policy measures, the question arises as to how the "Corona crisis" can be adequately captured. From the perspective of an evaluation of innovation funding programmes, the Corona pandemic represents an external influencing factor that could negatively affect the intended impact of a funding programme with regard to the successful implementation of innovation projects and behavioural change of actors towards innovation orientation.

This is relevant insofar as the impact of a programme affected by the Corona pandemic measured by an evaluation could thus be lower in comparison to other programmes that were not implemented during the Corona pandemic, without this being attributable to the programme itself. In addition, the pandemic has led to adjustments and changes (e.g., other forms of communication, extensions of the programme duration, new thematic focuses) in the projects, which in turn are likely to have both intended and unintended effects.

This article provides initial answers to the questions of what effects the Corona pandemic has had on innovation funding, what adaptation strategies can be observed and how these can be provisionally evaluated. For this purpose, the authors of this paper draw on current, previously unpublished data from evaluation surveys in 2020 and 2021. Five evaluations and monitoring processes of innovation funding programmes of the Federal Ministry of Education and Research (BMBF), the Federal Ministry for Economic Affairs and Climate Action (BMWK) and the Federal Ministry of Transport and Digital Infrastructure (BMVI), which have been running since summer 2020, are examined. In the surveys, current and former grant recipients as well as experts were asked about the impact of the Corona pandemic. In total, data from eight survey rounds are available. The main motivation for the selection of the measures under consideration was the availability of data within the framework of ongoing evaluations.

The article presents the first results of these surveys as examples. Furthermore, a possible impact model is proposed that takes into account the external shock "Corona" on ongoing innovation processes. Finally, possible further research needs and strategies are presented.

2 INFLUENCE OF PREVIOUS CRISES ON THE INNOVATION SYSTEM AND CURRENT PAN-DEMIC-RELATED TRENDS

The discussion on the possible impact of the pandemic on research and development (R&D) is based not only on current observations but also on findings from previous crises. The experience of the 2008/2009 financial crisis in conjunction with observations of reactions to it suggest that private R&D expenditure tends to be reduced procyclically in times of crisis. The reasons for this are primarily short-term financing bottlenecks of companies as well as uncertain expectations regarding market developments (Dachs / Peters 2020). As a result, fewer contracts are awarded to research service providers such as Fraunhofer institutes, universities and universities of applied sciences. Furthermore, there is an overall withdrawal from R&D projects (Azagra-Carrea et al. 2020). For German research institutions, this means a noticeable decline in third-party funding, at least temporarily, with corresponding consequences for funding opportunities and staff continuity (Estermann 2020).

However, the experiences of the financial crisis also speak for an anti-cyclical innovation behaviour of a few companies and thus for a further differentiation of the corporate landscape (Dachs / Peters 2020). In addition, studies show that large international technology groups in particular tend to come through the crisis better than smaller companies (Economist 2020). Overall, these trends are likely to lead to a further spread of the national and international corporate landscape into a few successful, highly innovative technology champions and the broad mass of less innovative and thus less productive companies in the long term. This poses a risk to the competitiveness of the German economy in the medium to long term.

The effects are likely to be particularly serious for small and medium-sized enterprises (SMEs). Scientific study results suggest that a withdrawal from research is difficult to reverse, especially for SMEs, as it goes hand in hand with the dismantling of relevant internal structures and competences and the access barriers for re-entry become higher (Rammer / Schubert 2016). The declining innovation orientation in the breadth of German SMEs, which was already observed before the Corona pandemic, could be further intensified by this.

By mid-2021, numerous data on the effects of the pandemic on the innovation system were already available. For example, various indicators (number of patents, innovation expenditure) and industry data point to a slight decline in innovation activities (European Patent Office 2021, ZEW 2/2021). According to a survey by the German Centre for Economic Research (ZEW), companies in Germany expect a slight decline in innovation expenditure of 2.2 per cent in 2020 compared to 2019. Although the decline is significantly smaller than in the financial crisis (decline of eleven percent in the financial crisis of 2009), it is more pronounced for smaller firms than for large ones (ZEW 7/2021).

Start-up activities were also affected by the pandemic and generally declined more in 2020 than in previous years (KfW 2021). In contrast, the financing of innovative start-ups in Europe has tended to improve despite the crisis (EY 2021). The number of financing rounds in Germany rose by 62 percent to 588 in the first half of 2021, reaching a new record level. The total value of financing rounds also jumped to €7.58 billion (EY

2021). Overall, however, it is apparent that young innovative companies have been hit harder by the crisis in comparison (ZEW 11/2020).

Meanwhile, data is also available on the consequences for research and innovation funding. For example, the German Research Foundation (DFG) recorded an overall decline in research proposals in basic research for 2020 (DFG 2021). The same applies to application-oriented research funding programmes, which address not only research institutions and universities but also companies.

In contrast, figures for the start-up support programme EXIST show that interest in funding in the area of start-up support continued unabated even during the Corona pandemic (Munich Startup 2021). In 2020, 426 applications were received for the EXIST start-up grant. This was a peak since the programme was launched in 2007. This could indicate a stronger focus on self-employment entrepreneurship during the crisis.

3 IMPACT MODEL: INTEGRATION OF THE COVID19 EFFECT AS AN EXTERNAL INFLUENCING FACTOR

Most evaluations are based on a programme theory. The starting point of an evaluation is therefore usually an impact model of the measure under investigation and its environment. As a rule, external as well as internal factors of influence are taken into account, including the Corona pandemic. In order to be able to take this new effect into account appropriately, an impact model was developed that can be applied in a generalised form to different funding measures in the policy field of research, technology and innovation policy. It traces typical impact paths and highlights the influence of Covid19 (Figure 1).

It can be assumed that economic slumps caused by the pandemic lead to a worsening of the economic situation of subsidised companies, which in turn change their innovation behaviour and focus more on existing business, which stabilises turnover in the short term, instead of investing in future turnover within the framework of R&D projects. Furthermore, there is an assumption that resource bottlenecks caused by border closures in the first peak phase of the pandemic in spring 2020 lead to delays in project implementation. The delays in turn have a negative impact on project utilisation, e.g., because the product launch on the market is delayed.

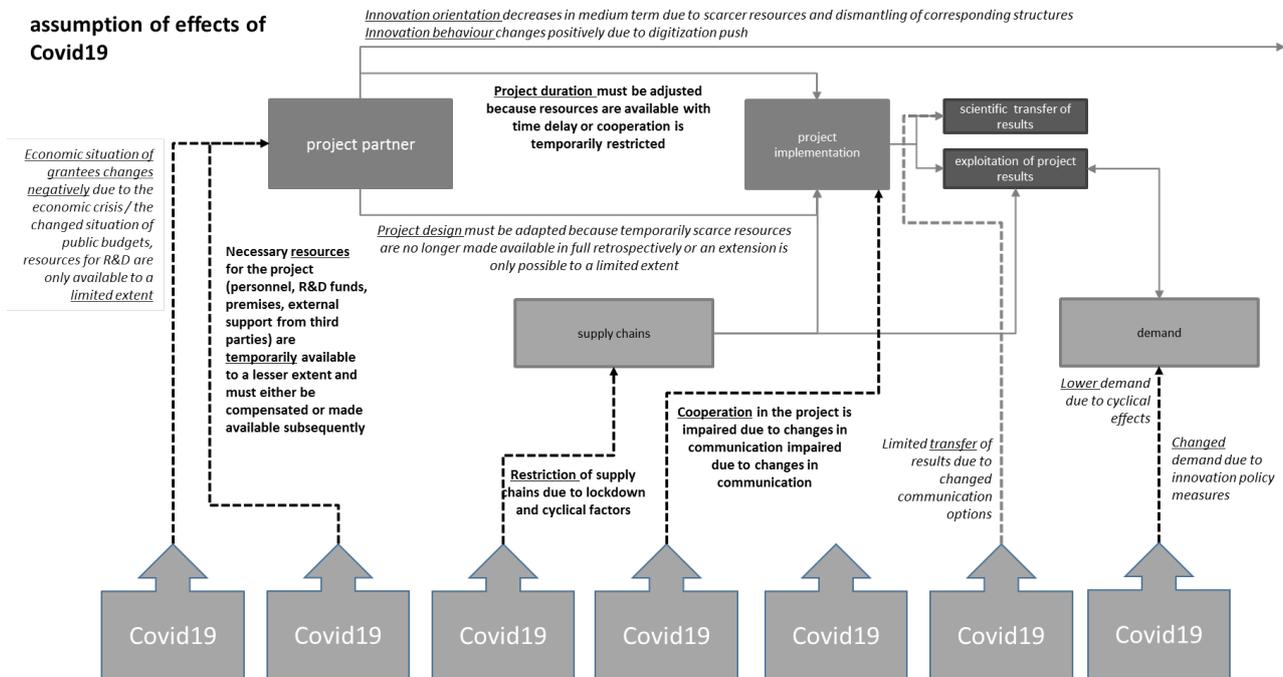
The following primary cause-effect relationships can be assumed:

- Due to temporarily reduced internal resources, interrupted supply chains and/or limited communication in the project team, some projects take longer or require more resources.
- If these temporary constraints cannot be compensated for in the course of the project, the project design of some projects will be changed, potentially leading to less successful or less "effective" projects.
- The markets and thus demand also change due to cyclical effects and/or additional Corona-induced political measures (e.g., in favour of future-oriented technologies such as electromobility), which in turn influences the impact of the projects and thus of the overall programme.
- In addition, the innovation behaviour of the actors could change during the crisis. In the medium term, changes in the availability

of resources could have a negative effect, whereas the digitalisation boost experienced during the crisis could have a positive effect.

The effects that have already been proven to some extent by initial data are shown in bold, while the effects that have not yet been empirically proven are assumed in italics.

Figure 1: Impact model - influence of the Corona pandemic on R&D projects



4 EMPIRICAL FINDINGS OF COVID19 PANDEMIC EFFECTS ON GERMAN R&D FUNDING SCHEMES

The effects of the Corona pandemic on grantees in several innovation funding programs are shown below. What all programs have in common is their focus on applied research projects that are usually carried out by a consortium of project partners from both academia and the industry. Most funded projects deal with technological innovations. The programs are presented in anonymized form (A to E), and are the responsibility of the following German federal ministries:

- Federal Ministry of Education and Research (BMBF).
- Federal Ministry for Economic Affairs and Climate Action (BMWK)
- Federal Ministry of Transport and Digital Infrastructure (BMVI)

The authors of the study carry out evaluation and monitoring activities of all programs on behalf of the respective ministries. To assess program implementation, achievements and impact, funding recipients

have been addressed with online surveys. In order to measure the corona effects, a set of specific questions on possible effects due to the corona pandemic was integrated into the surveys conducted.

The surveys took place at two points in time in summer 2020 and 2021. For one programme, there was an additional survey wave in spring 2021.

Programme E differs from the other programmes in that experts were interviewed rather than funding recipients. The questions were therefore not directed at the effects of the Corona pandemic on an individual funding project. Instead, the influence on innovation in general was considered.

The results presented must be interpreted against the background of the course of the pandemic. The intensity of the pandemic had eased somewhat in the summer of 2021 compared to the previous months, but the respondents from the survey wave in the summer of 2021 answered against the background of a severely restrictive lockdown in the winter of 2020/21. In addition, the expectation was that the coming winter could again lead to an increase in incidence levels and renewed restrictions on public life. In contrast to the first survey in the summer of 2020, one year later the respondents had already gained experience in dealing with the pandemic over a period of months; in addition, various adaptation strategies, especially through the digitalisation of processes and communication formats, had already been implemented for some time.

It should be noted that the questions asked were not the same for all programmes but were adapted to the specific features. This means that a direct comparison between the programmes is only possible to a limited extent.

4.1 PROGRAMME A

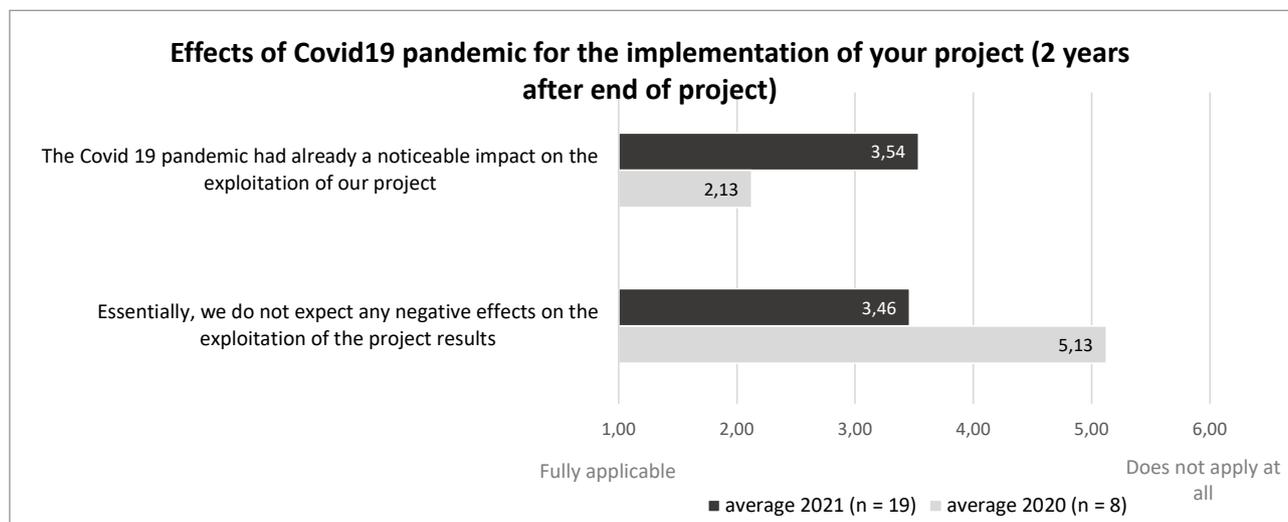
For Programme A, a comparison of the two surveys in 2020 and 2021 shows that the assessments of the severity of the impact of the pandemic on the projects in the following year 2021 are mostly more pronounced than a year earlier.

For projects still in progress, both negative consequences (e.g., limited staff availability, postponement of work packages) and positive effects (e.g., increasing demand, added value through the use of versatile digital formats and communication tools) are mentioned more frequently in 2021 than in 2020. This observation can be interpreted to mean that the responses to the 2020 survey were still borne by a certain optimism from the early days of the pandemic, and there was hope that the effects would not be so severe. One year later, there were already concrete experiences from the second half of 2020 and the first half of 2021, so

that both positive and negative effects were weighted more heavily. In addition, it can be concluded from the data that although adaptation strategies of digitalisation were considered successful and positive to a certain extent, fundamental challenges such as limited personnel availability could not be sufficiently compensated.

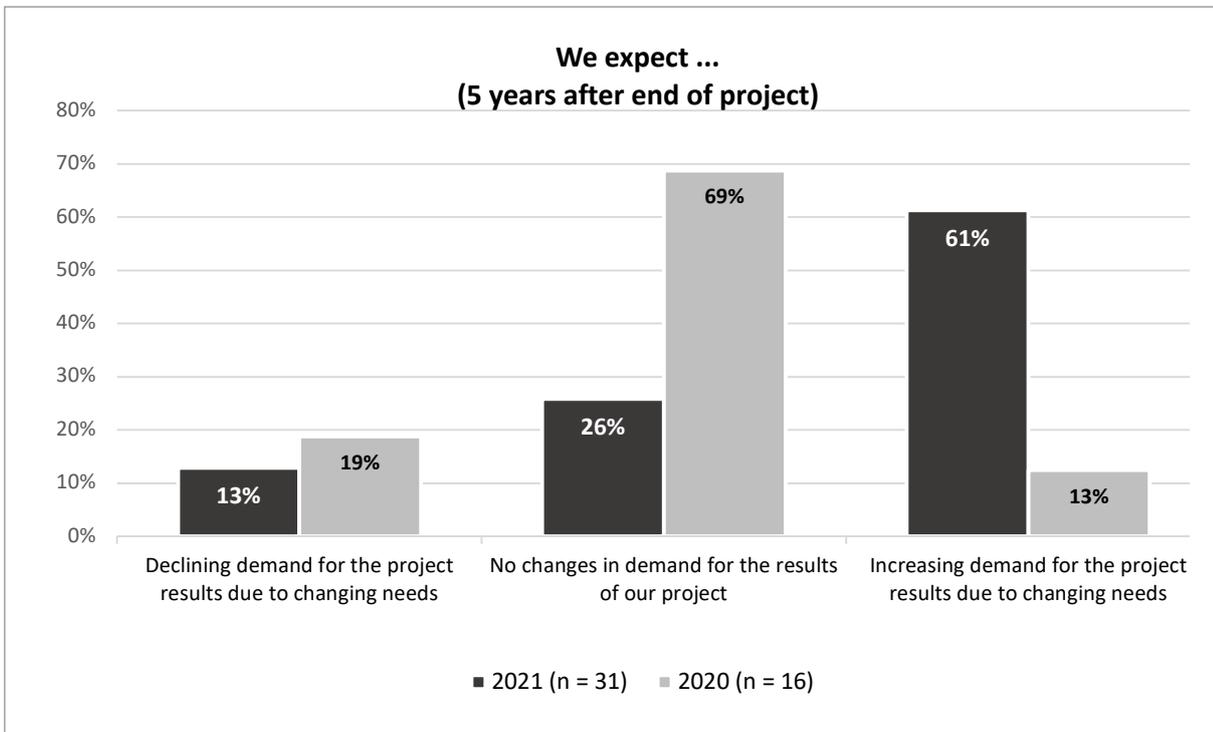
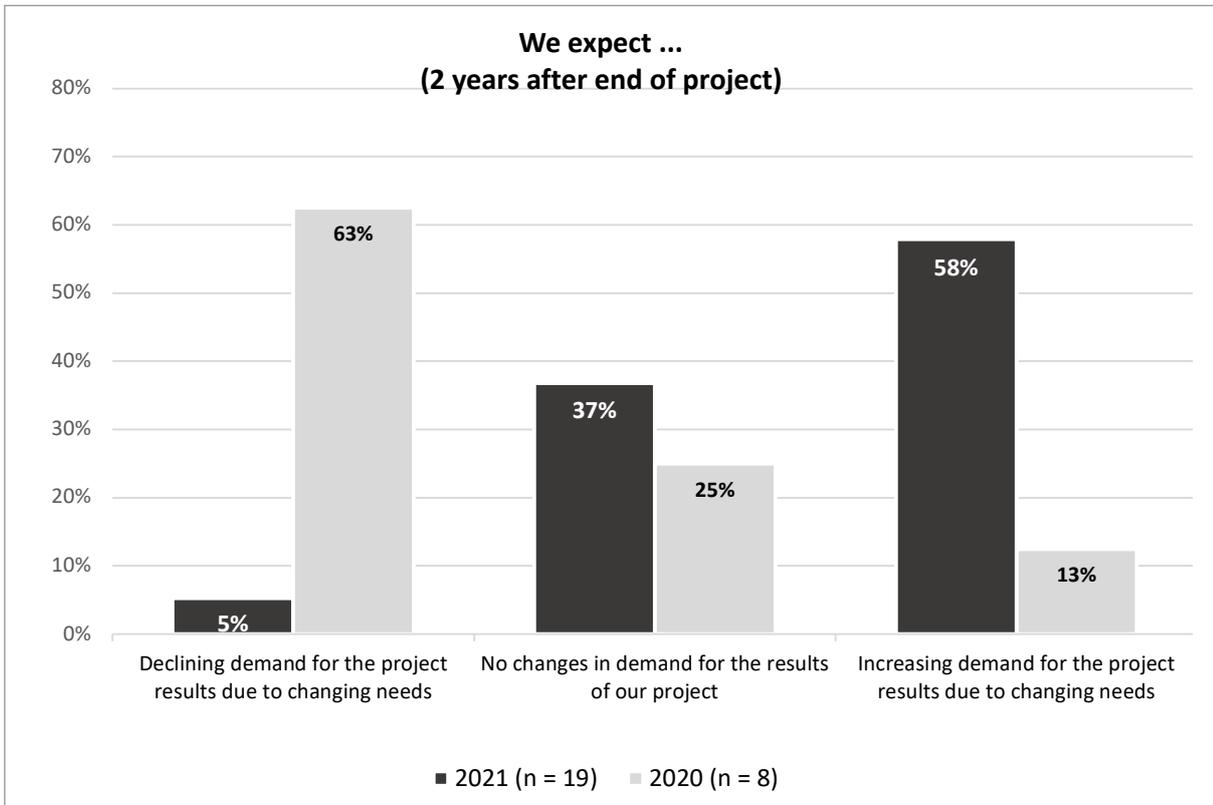
Grantees whose projects had already been completed for some time and were in the exploitation phase assessed the impact of the Corona pandemic in part significantly differently from those respondents who had to implement their projects during the pandemic (figure 2). Anticipated negative impacts of the pandemic were rated as lower in 2021 compared to 2020 by respondents who completed their project about two years ago. Respondents from projects completed five years ago anticipated negative impacts somewhat differently. This group estimated that the potential negative effects would be somewhat lower in 2021. This could be due to the fact that the group in the 2020 survey with project completion more than five years ago had already completed all major implementation steps, while the projects in the 2021 survey were had only been completed for about 1 to 1.5 years at the beginning of the pandemic and were still more in the process of implementation. However, less negative effects were expected in 2021 than in 2020.

Figure 2: Impact of the CORONA pandemic on project implementation (2 vs. 5 years after project completion)



In 2021, the respondents are much more optimistic about the potential demand for their project results compared to the previous year. Whereas in 2020 the projects in the 2-year follow-up survey still predominantly expected falling demand, this assessment turns towards rising demand in 2021. A similar change can be observed in the projects with a greater distance to the end of the project (5-year follow-up survey).

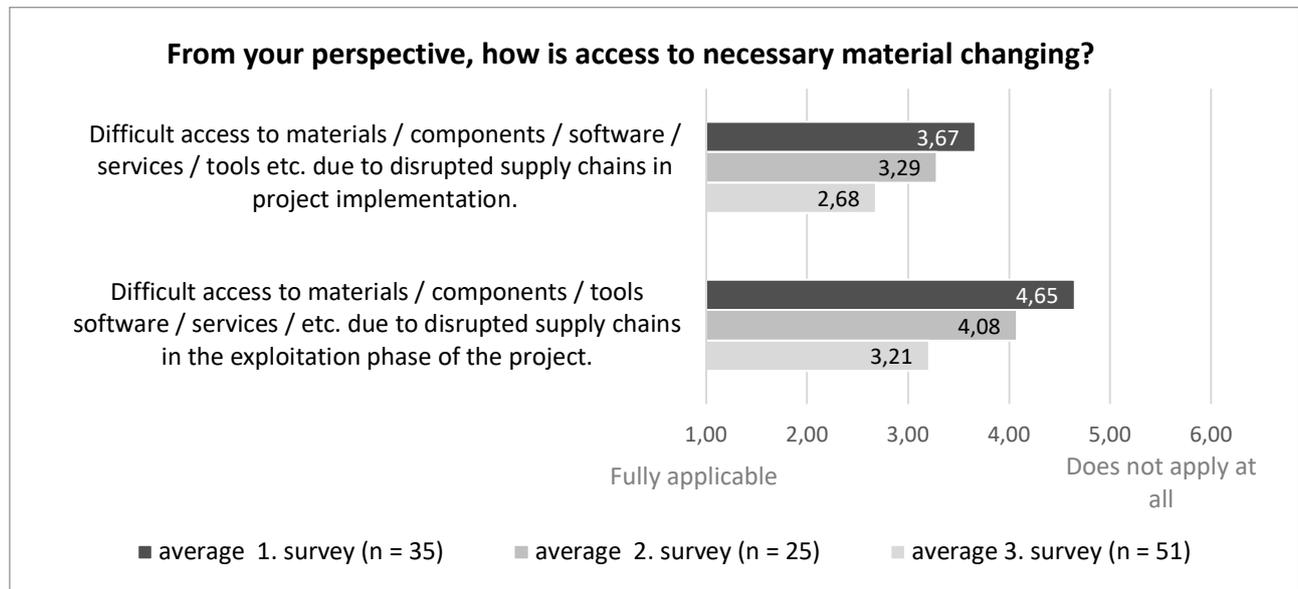
Figure 3: Expectations of demand for project results (2 vs. 5 years after project completion)



4.2 PROGRAMME B

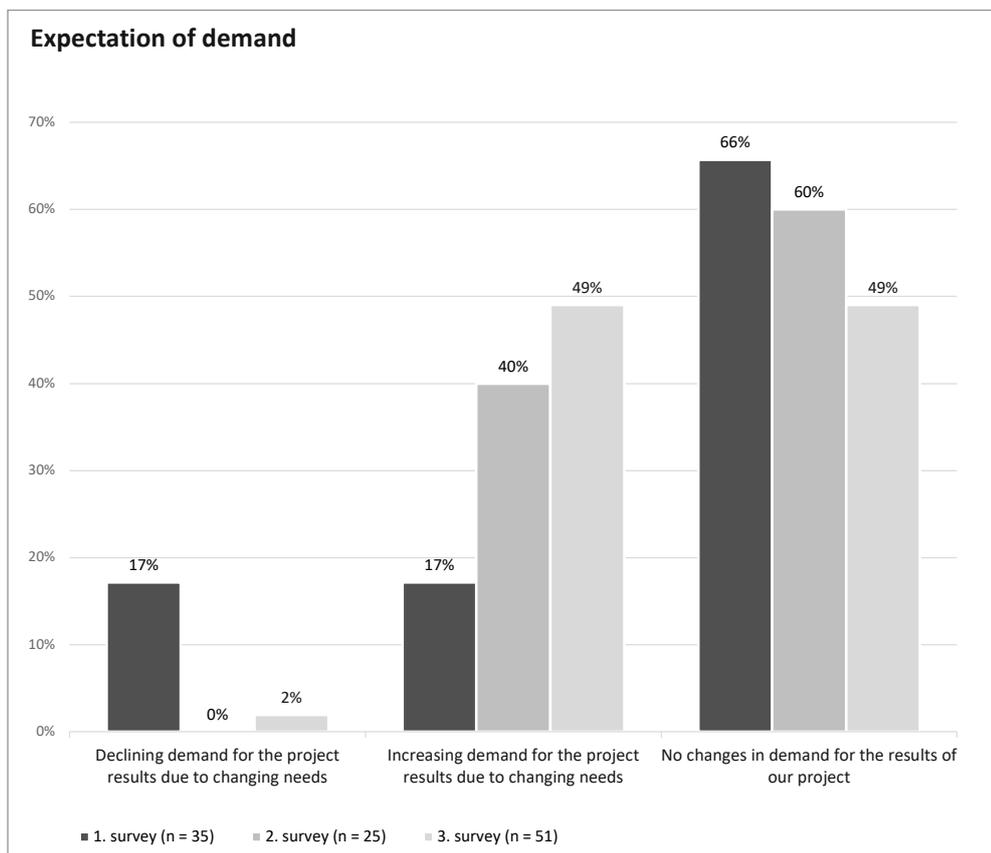
In the evaluation of programme B, data from three survey waves of projects still running between summer 2020 and summer 2021 were analysed. It can be seen that the pandemic affected the logistics chains, which led to significantly more difficult access to material in this programme. This effect increased over time (Figure 4).

Figure 4: Access to material. 1st-3rd survey in the period summer 2020 to 2021



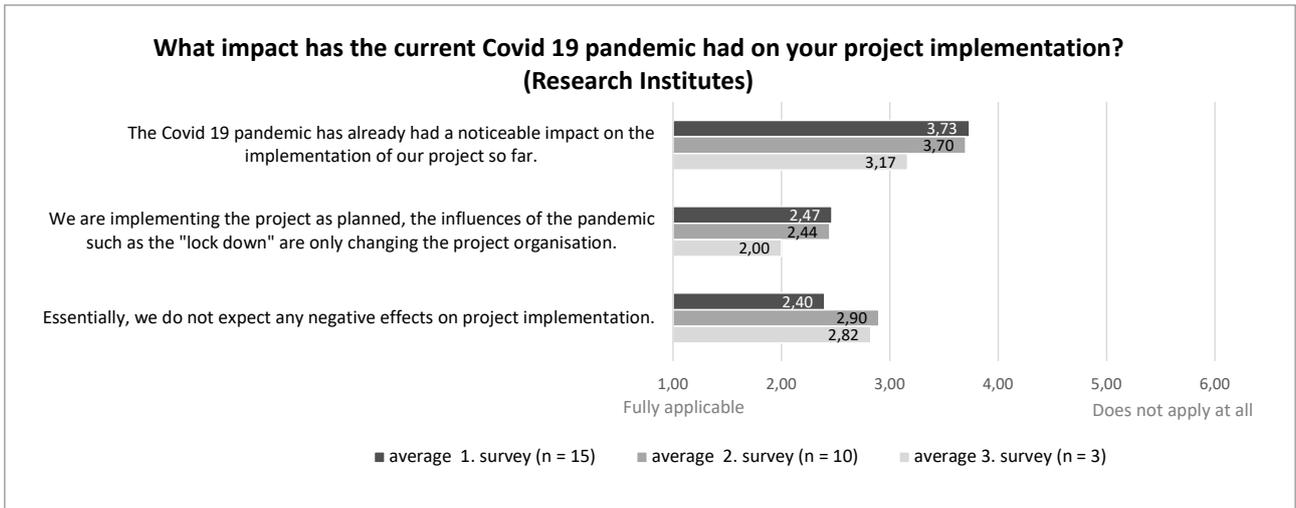
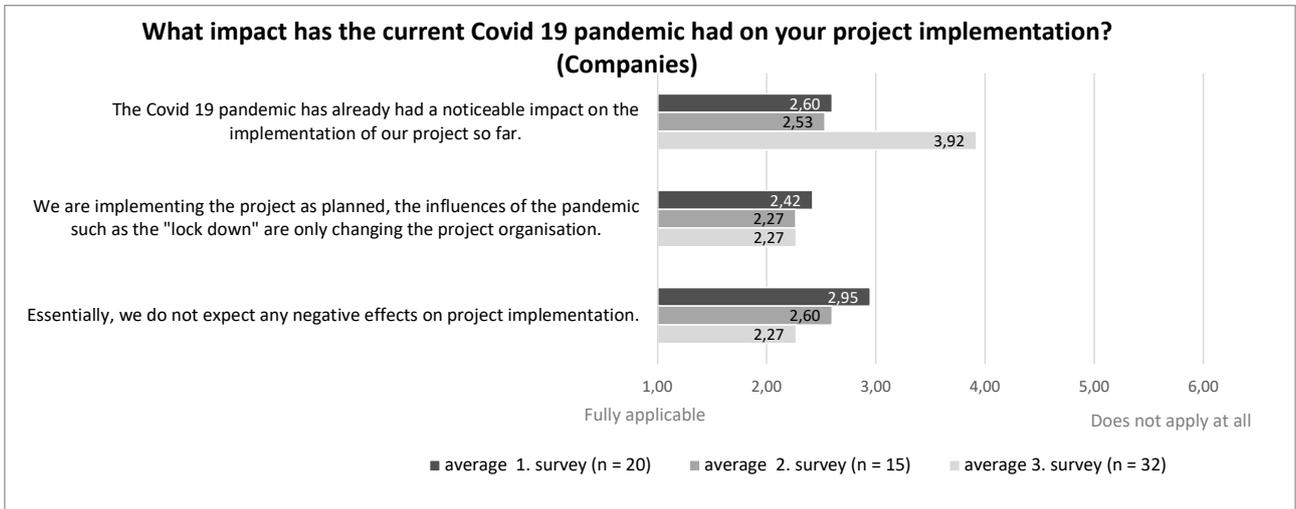
At the same time, a change in demand for the project results is expected in the course of the survey waves in this programme. While this effect was predicted to be negative or positive to a similar extent in the first survey (summer 2020), the expectation of a positive effect clearly prevails in the latter survey (summer 2021).

Figure 5: Expectation of demand for project results. 1st-3rd survey in the period summer 2020 to 2021



Since Programme B involves the funding of collaborative projects, different effects can be analysed here according to the type of actor. While in the first survey wave in summer 2020 companies reported more clearly on the possible effects of the pandemic (“noticeable impact”) and are more optimistic in summer 2021 (“we do not expect any negative effects”), research institutions initially assessed the effects of the pandemic more cautiously but are more critical in summer 2021 (Figure 6).

Figure 6: Impact on project implementation (companies vs. research institutions)

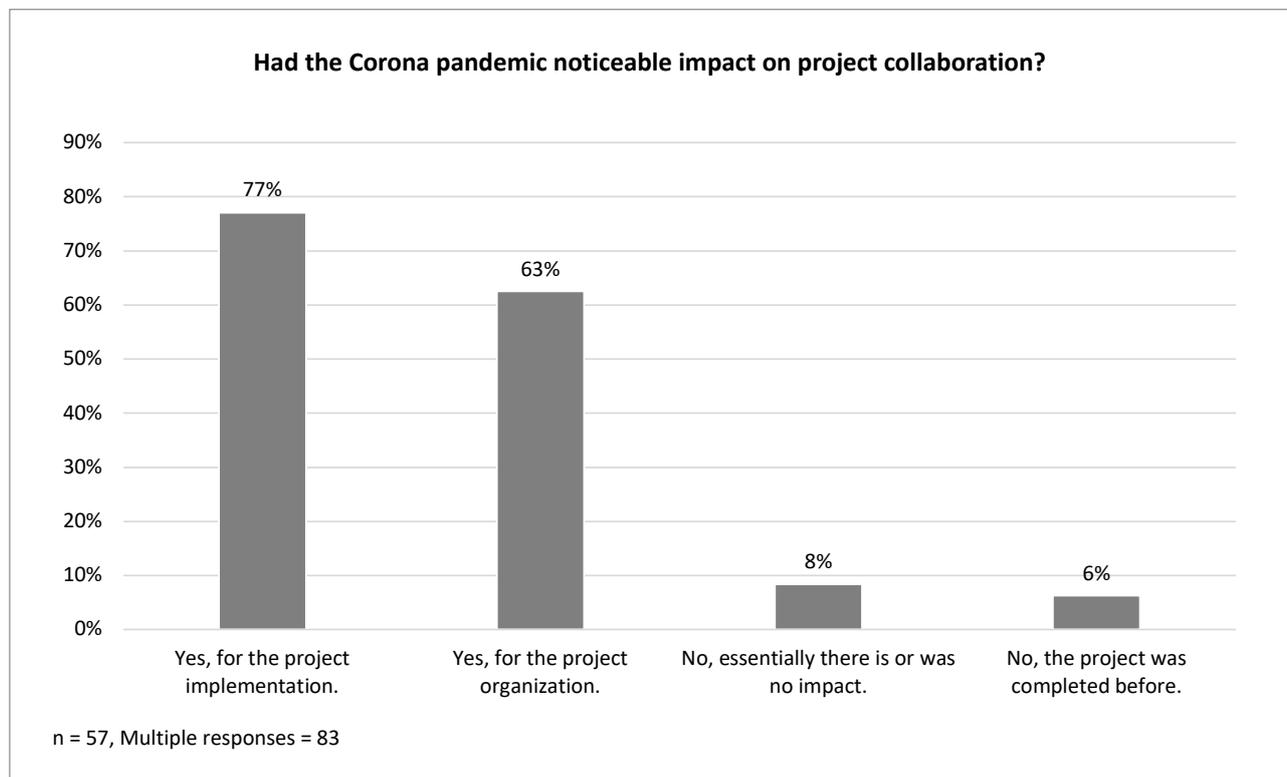


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4.3 PROGRAMME C

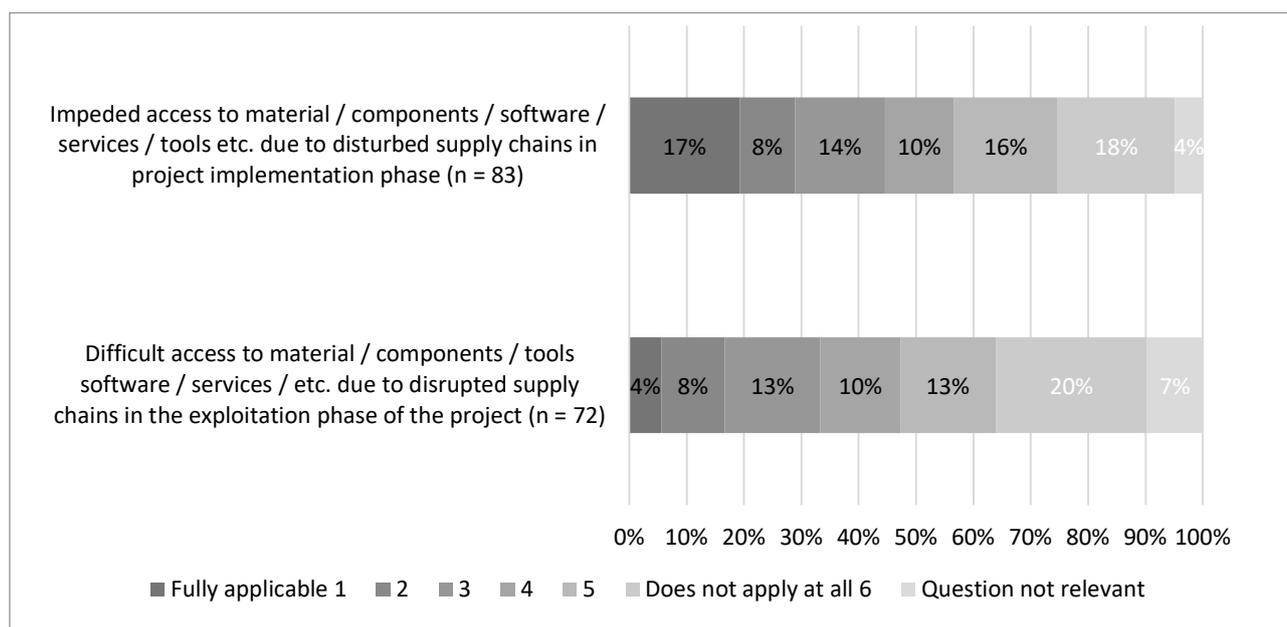
In Programme C, a good two-thirds of respondents reported strong effects on project implementation (77 percent) as well as project organisation (63 percent) (Figure 7).

Figure 7: Impact of the Corona pandemic on the joint project



In contrast, the grantees' perception of the Corona effect on access to materials, components, software, etc. is mixed. Respondents vary in the extent to which they are affected by the Corona-related effects, from high effects to no effects at all (Figure 8).

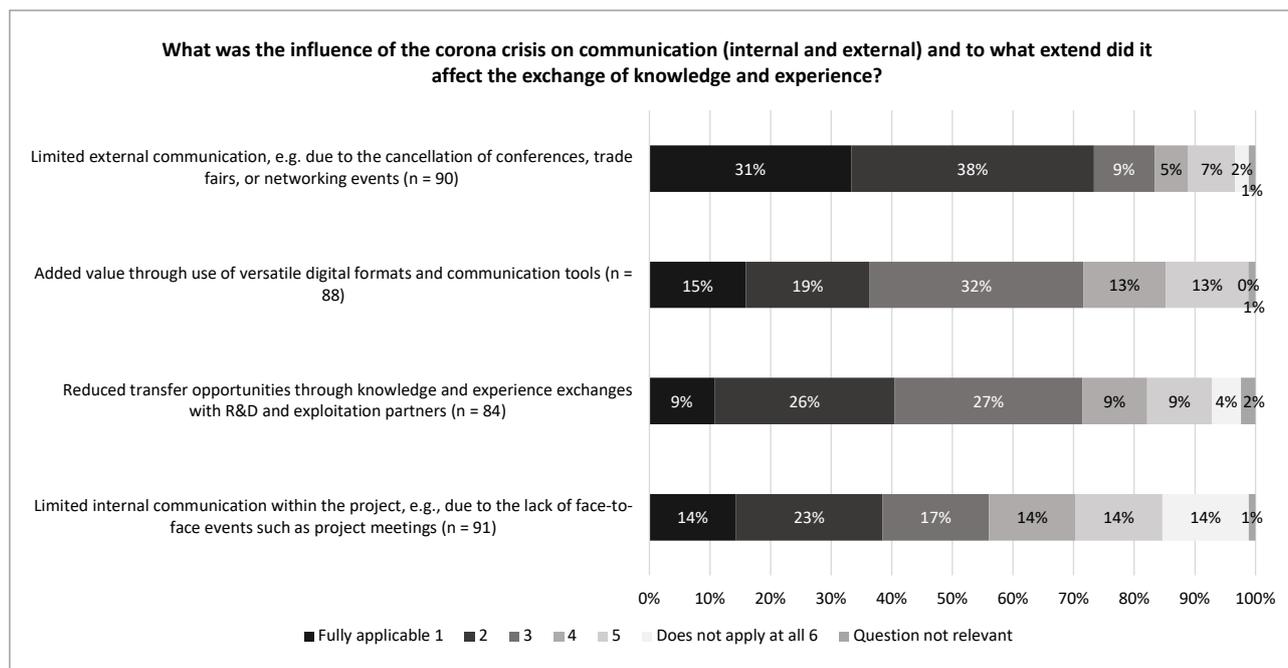
Figure 8: Impact of the Corona pandemic on project implementation
 Source: Online survey, representation iit



The survey also aimed to explore potential impacts on communication (Figure 9). Limited external communication was perceived as a key effect of the Corona pandemic. More than two-thirds of the grantees (69 percent) stated that, for example, due to the cancellation of conferences, trade fairs or networking events, the exchange on project-specific and cross-cutting issues suffered. This gap was compensated for by digital formats and communication tools. One third (34 percent) of the respondents see added value here. Another relevant hurdle is seen as limited

internal communication, because face-to-face events such as project meetings have been eliminated. About one third (37 percent) of respondents agree that internal communication has deteriorated, although almost one third (28 percent) also see no perceptible deterioration in internal communication. Finally, about one third (35 percent) of respondents perceive a deterioration in transfer opportunities due to reduced exchange with R&D and exploitation partners.

Figure 9: Impact of the Corona pandemic on communication



In programme C, respondents also provided detailed information on the obstacles that led to delays. For example, planned projects were cancelled during the pandemic (e.g., final demonstration, joint meeting for a project conclusion, cancellation of a study with test persons). Supply bottlenecks also meant that projects could not be implemented as planned. Communication was sometimes severely restricted, e.g., due to home office arrangements and short-time work during the lockdown. This resulted in considerable time delays. The change in user behaviour had an impact on the success of individual projects because relevant project goals for researching user acceptance could not be implemented to the planned extent. Access to laboratories as well as business trips to project partners also became more difficult for some project participants.

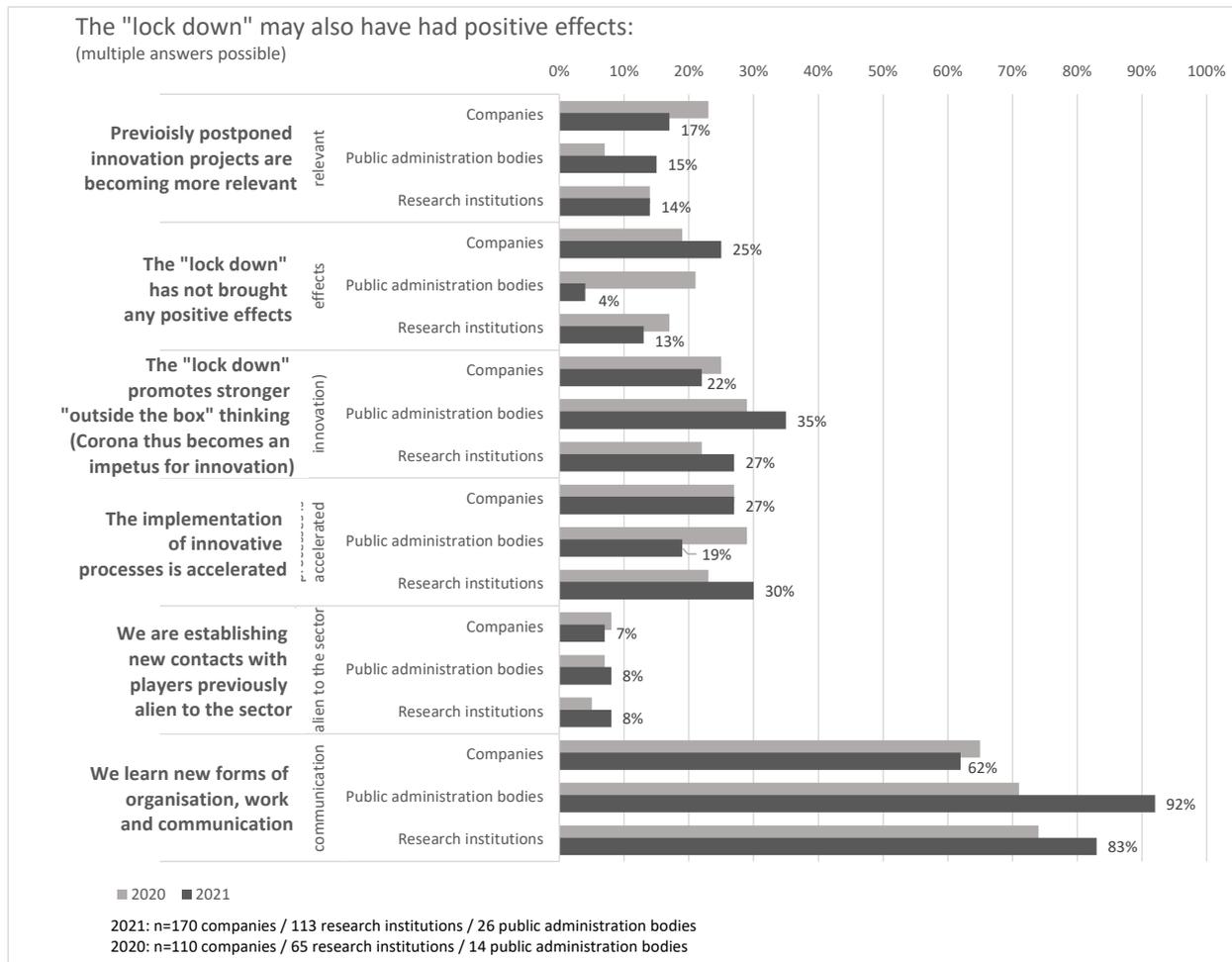
4.4 PROGRAMME D

In Programme D, funding is provided not only to companies and research institutions, but also to municipal agencies and authorities. Here, the survey data was evaluated at the actor level (companies, research

institutions, municipalities and administrations). One of the questions asked was whether there were also possible positive effects from the pandemic (Figure 10). It turns out that the crisis has had no positive effect at all for only a few respondents. In fact, in 2020, around two-thirds of respondents already reported positive experiences with regard to new forms of organisation, work and communication. In 2021, this effect is perceived by the research institutions and municipalities/public administration institutions to be significantly stronger than in the previous year. In contrast, only a minority report positive effects that go beyond this, whereby differences between the groups of actors can also be observed here. In 2021, one third of the administrations stated that the "lock down" had led to increased "out of the box" thinking within their institutions. This effect was less pronounced in the case of companies. For every fourth company, the "lock down" led to an acceleration of innovative processes.

In principle, the data do not indicate any major differences between the situation in the summer of 2020 and the summer of 2021; the prevailing positive effects are constant across all groups of actors.

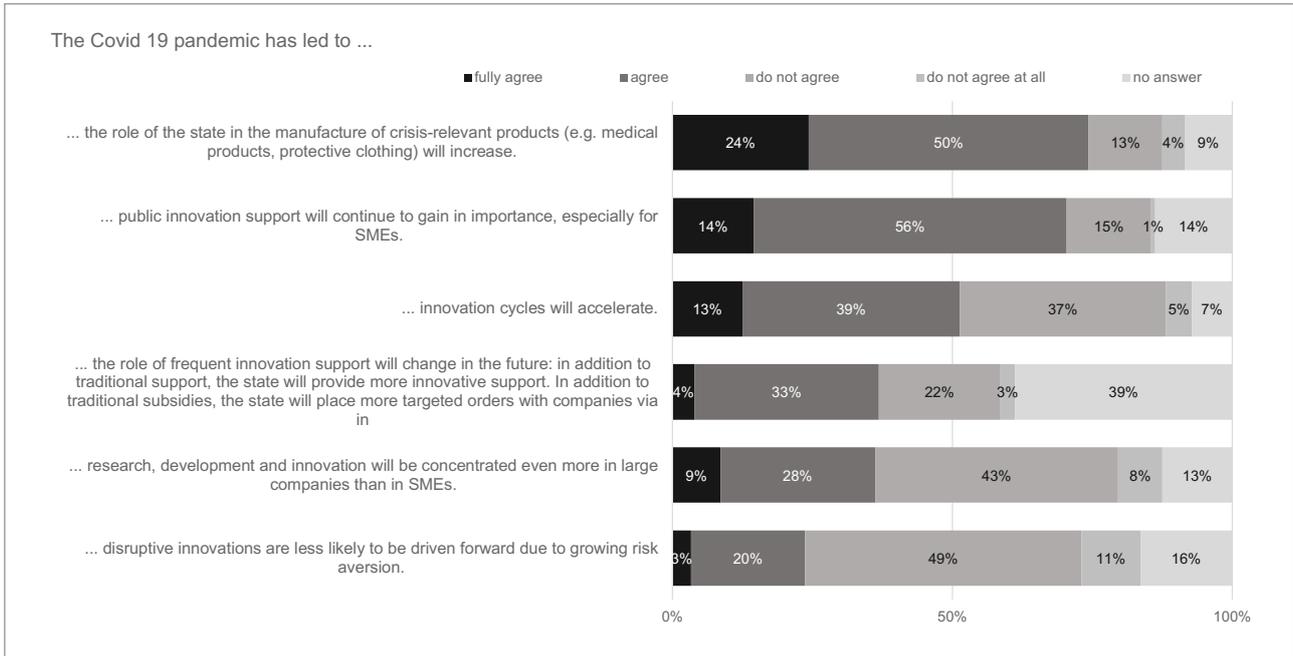
Figure 10: Positive effects from the lock down



4.5 PROGRAMME E

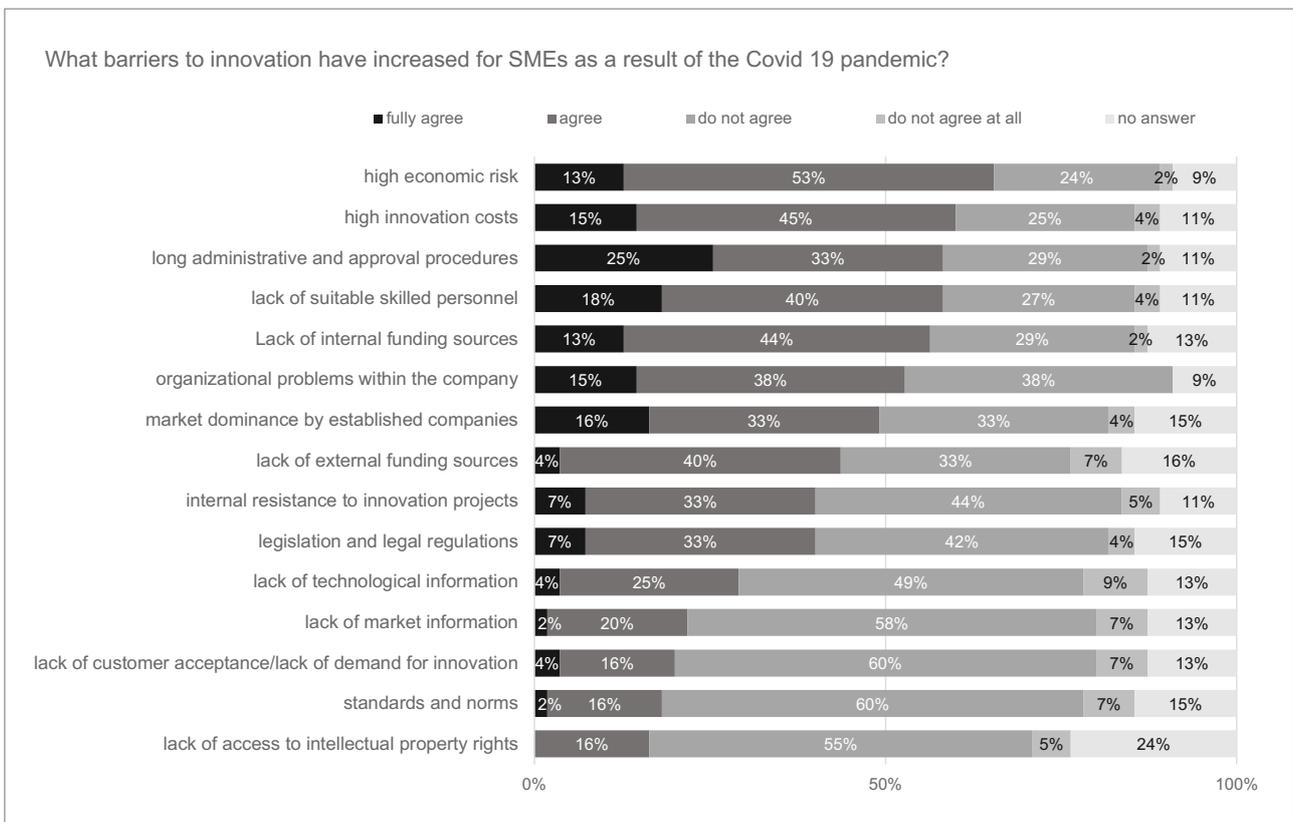
In Programme E, 152 experts were asked about the impact of the Corona pandemic on research and innovation. A large proportion agreed that innovation cycles accelerated in the wake of the pandemic and that the importance of public funding increased at the same time (Figure 11). In the future, a stronger role of the state in crisis management is seen, for example, in the production of protective clothing (74 percent agreement) and in innovative public procurement for the targeted promotion of companies (59 percent agreement). In the view of the experts surveyed, innovation promotion will become more important, especially for SMEs (70 percent agreement). This is also considered important because the respondents assume that R&D efforts will focus even more on large companies in the future, while SMEs could fall behind (80 percent agreement). When asked whether a possible risk aversion could lead to fewer disruptive innovations in the future, only one fifth of the respondents are of this opinion (23 percent agree).

Figure 11: Positive effects from the lock down



The survey results also indicate that the Corona pandemic causes barriers to innovation, especially for SMEs (Figure 12). The top three barriers to innovation are cited as: economic risk (66 percent agreement), innovation costs (60 percent agreement) and long administrative and approval procedures (58 percent agreement).

Figure 12: Innovation barriers in the wake of the Corona pandemic for SMEs



Other barriers to innovation that have increased as a result of the Corona pandemic in the view of the experts interviewed are access to skilled personnel, financing and market dominance by individual, established companies; internal organisational barriers are also mentioned.

5 CONCLUSIONS

This contribution aimed to provide initial explanations of the Corona pandemic's effects on innovation promotion and chosen adaptation strategies. In addition, the question of how the "Corona crisis" can be adequately captured in evaluations was explored. Our investigations show that the impact assumptions we made in the impact model can largely be traced with Covid19 as an external influencing factor.

Particularly at the beginning of the pandemic, the effects led to a reduction in internal resources, restrictions in staff availability, as well as changes in priorities and resulting adjustments in the timing and content of research projects.

Supply chains were interrupted and access to materials became more difficult. External communication in particular deteriorated because participation in trade fairs and conferences was not possible. The contact restrictions also had a significant impact on internal communication in the project teams. Especially for projects that started or were still running during the pandemic, there was a risk of longer running times and difficulties in marketing the project results in a timely manner. Project organisation and implementation was significantly more difficult.

Projects that have already been completed for a longer time and are already in the transfer phase were somewhat less affected by the corona crisis. Also, not all types of actors were affected to the same extent; while some suffered very great disadvantages, others were only confronted with a few restrictions. Differentiated by actor groups, the effects of the pandemic were felt particularly strong in municipalities and public administration, while companies were the least affected. The public sector revealed its significant digitalisation backlog. For example, it found it much more difficult to switch its communication channels to video conferencing or to provide laptops for mobile working.

Many of the negative impacts in the research projects cannot be compensated for in the project period. Overall, this can lead to a somewhat poorer programme success. This special negative effect in the programme impact must be taken into account in future comparisons of funding programmes.

The survey results also show that expectations of demand for their project results changed over time. While many of the respondents were still very pessimistic about the demand for their project results in the summer of 2020, they were already more optimistic in the summer of 2021. This was also reflected in the first signs that the economy would develop positively again from 2022 at the latest.

Greater importance is being attached to the state as a stimulus and promoter. Innovative public procurement and innovation support, especially for SMEs, are seen as important levers. As outlined in the impact model, such Corona-induced political measures can have a positive effect on the results of projects and thus on the overall programme.

Last but not least, positive effects could also be traced, such as the digitalisation boost and an increase in innovation activity. New communication formats were tested, and innovations promoted through outside-the-box thinking. During the crisis, companies and employees experienced how quickly problems can be solved and changes can be shaped.

The data available so far show that the effects change over time. For this reason, an analysis of further effects in the coming years would be interesting in order to be able to estimate medium-term effects. This also

concerns structural effects, e.g., in the internal organisation of research projects on the part of project participants. At the moment it seems that the effects point in different directions and will be difficult to quantify - depending on the programme, there may have been an increase or decrease of demand or a delay in demand due to delivery difficulties, innovation may have accelerated or slowed down. Comparisons between programmes (e.g., in meta-evaluations) will need to consider this in detail as one cannot assume that the economic environment has continued to develop equally for all sectors and actors.

Also still outstanding is a systematic analysis of the adjustment steps on the part of the programme managers. In the short term, the requirements for project participants in the pandemic were relaxed in some funding programmes in order to mitigate specific challenges. Likewise, project extensions were approved more generously. Whether these adjustments to the programmes and gains in flexibility will last or be reversed is still an open question.

It also became apparent that innovation cycles have accelerated in the wake of the pandemic. The digitalisation boost is influencing and accelerating the transformation of important policy fields (climate/sustainability, mobility, health). Underlying reasons - perhaps because everything is in upheaval anyway (new actors, geopolitical changes) and the questioning of established structures and processes by the pandemic favour this - need to be investigated.

The pandemic has also shown that many things can be done more efficiently and less expensively. This learning process is just in its infancy. An intensive discussion about more agility and new funding formats has begun. More courage to experiment with new formats is desirable, ideally accompanied by evaluations, to see whether the cost-benefit ratio changes positively in the long term.

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