

Managing North-South Research Collaboration Projects During the COVID-19 Pandemic: An Empirical Study

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ABSTRACT

Researchers from the Global North and South have collaborated for decades to conduct cutting-edge interdisciplinary research. The tools they used to manage their research projects remained virtually unchanged until the COVID-19 pandemic outbreak early in 2020. Since then, a lot has changed, including the nature and dynamics of research collaboration. How are researchers and project managers adapting to this change? Survey data, semi-structured interviews, and personal accounts from 102 respondents from 33 countries are used in this empirical study to investigate the impact of the pandemic on research collaboration projects. An independent non-parametric t-test revealed a significant difference in the research collaboration infrastructure and home environment between Global North and global South collaborators. The findings have practical implications for people involved in collaborative research projects, funding agencies, project management professionals, and universities interested in pursuing or sustaining North-South research collaboration during the pandemic.

KEYWORDS

Clusters of Excellence, Collaborative Research Projects, COVID-19 Pandemic, Global North-South, New Normal, Online Survey, Project Management, Social Distancing

INTRODUCTION

In collaborative research, a globally distributed, sometimes co-located team of researchers works together to address research questions pertinent to their study. The consensus emanating from researchers, policymakers, and research funding organizations is that research collaboration is a good thing, and should be encouraged (Katz & Martin, 1997). Collaboration or research partnership can take many forms, ranging from a group of scientists in the same lab investigating the origin of a virus, to a consortium consisting of universities and companies working on a funded project to an interdisciplinary project involving researchers and principal investigators from universities in

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the Global North and South. Interdisciplinary North-South collaboration between researchers can bring distinct expertise to a project as well as produce new scientific knowledge. Furthermore, as acknowledged by Lee and Haupt (2021), research collaboration benefits not only low-income but also high-income countries as well.

The main characteristic of North-South research collaboration is that researchers are often geographically dispersed. They use a mixture of collaboration tools and personal face-to-face contacts to coordinate their research activities. Under normal circumstances, they can travel and meet in small groups to discuss their research in a workshop, seminar, or conference. Exchange visits and other social activities are also sometimes undertaken by research collaborators to promote interpersonal interactions and bonding. Researchers can also use emails, video conferencing, or social media platforms to communicate with their colleagues when the need arises. However, since the WHO declared the outbreak of COVID-19 on January 30, 2020 to be a public health emergency of international concern, many *normal* research collaboration activities have almost become impossible. What followed the WHO declaration was the dawn of the “New Normal” era that continues to bring unprecedented socioeconomic, public health, and scientific challenges for society in general and North-South research collaborations as people knew it.

Motivation

As members of the Africa Multiple Cluster of Excellence¹ at the University of Bayreuth, Germany, the authors are involved in several open collaboration research projects with partners from the North (Europe) and South (Africa). The research projects are parts of the Clusters of Excellence research projects funded by the German Excellence Strategy. Cluster members have a long history of interdisciplinary North-South research collaboration. The aim of the Cluster, among other things, is to develop a digital research environment for reconfiguring African Studies (Seesemann, 2020). The pandemic continues to have profound organizational and communication consequences for project management professionals, virtually changing the way they used to work. Like many other collaborative projects, the COVID-19 pandemic heavily impacted the authors’ North-South research collaboration projects. The motivation for this research is to understand how to manage research collaboration projects during the COVID-19 pandemic. The authors also share their experiences and lessons learned with practitioners, researchers, project managers, and information systems specialists. Project management uses specific tools and techniques to deliver a valuable product to the people or communities concerned. In their research collaboration projects, the product is, for example, a research collaboration platform, scientific publications, skill-sets, or even domain knowledge of a specific subject or region.

To develop a thorough understanding of project management during the pandemic means that the authors’ analysis must help them understand the challenges involved in managing the resources and outputs of the projects. Noting that the chance of face-to-face meetings and knowledge exchanges among researchers might not be possible during the pandemic, research collaboration project managers also need to understand the communication technologies and strategies that project professionals are using to overcome geographical distance and compensate for the absence of in-person meetings.

Contribution and Research Questions

Many countries have implemented measures to help reduce the spread of the SARS-CoV2 virus and its OMICRON variant. Measures like closing public places and research institutions (schools and universities), restricting travel (land, sea, air), canceling events (conferences, workshops), social distancing, and enforcing lockdowns or stay-home orders are now common around the globe. Although these measures resulted in the cancellation of some research collaboration projects and activities, others continued and adapted to the COVID-19 crisis by embracing collaboration and coordination technologies for remote work (Zaer et al., 2020), and at the same time, new projects started in Europe, the Americas, Africa, the Pacific, and ASEAN regions.

The pandemic is not only affecting the way researchers conduct research locally, but it has propelled North-South research collaboration to the forefront of public discourse in both the public and private sectors. Everyone involved in the management of research collaboration projects is rethinking, reinventing, searching for creative project management solutions, and learning and investing in new technologies to help him/her continue doing research and collaborate with partners across borders in an intuitive way. Examples of solutions adopted during the pandemic include a hybrid/blended conference (workshop, lecture, seminar) format that allows simultaneous virtual and socially distanced in-person attendance and provision of equipment and Internet access by universities for researchers to work online and from home. Furthermore, Zaer et al. (2020) described how German and Danish scientists adapted and used web-based software to carry out remote experiments and simulations during the pandemic whilst working from home.

A review of the literature on managing research collaboration during the COVID-19 pandemic reveals that many studies emphasized the importance of research collaboration in general (Lee and Haupt, 2021), co-authoring publications (Cai X et al., 2021), research collaboration projects in healthcare and vaccine development (Muqattash et al., 2020), to mention a few. Most of these studies lack a theoretical foundation, analytical techniques, or empirical investigation that can help us improve the authors' understanding of how to manage interdisciplinary research collaboration projects involving researchers from the Global North and South. Thus, best practices and lessons learned to support interdisciplinary North-South research collaboration project management during the COVID-19 pandemic are lacking in the literature.

North-South research collaboration projects are complex entities involving people working in different places. In addition to the complexity, research projects are also full of uncertainty. The authors went on to argue that, in particular, "research has substantial elements of creativity and innovation, and predicting the outcome of the research (or research project) in full is therefore very difficult." Managing the projects is a challenge because the quality of the technological research infrastructure is starkly different for each partner or region. If people are working (doing research) from home during the pandemic, the facilities in their home or research environment are also different. This complexity and uncertainty, combined with the unpredictability nature of the pandemic, leaves many unanswered questions for researchers and practitioners interested in managing collaborative research projects. For instance, how are researchers and project managers adapting to the new way of working? What do they need to do differently? What technologies and collaboration platforms should they use to succeed? How is working from home affecting their ability to collaborate with project members?

A possible approach to understanding the complexities involved in managing North-South research collaboration projects during the pandemic is to use an online survey to ask project members and managers a battery of questions and analyze their responses. An online survey is appropriate because the COVID-19 pandemic is providing a fundamental challenge for contacting study subjects (Bian & Lin, 2020). To buttress this point, project management researchers, for example (Wahbi et al., 2020), reported that it is not possible to have face-to-face contact with study subjects because of social distancing and lockdowns. Thus, a survey approach can help researchers understand the personal opinions and unique challenges associated with North-South research collaboration projects. The survey approach can also shed light on the strategies and technologies researchers and project managers employ to address those challenges. Therefore, this study attempts to answer a series of research questions, broadly grouped into the two major sections:

Q1: Research collaboration infrastructure: *What communication and coordination technologies are North-South researcher collaborators using to help them collaborate with their partners during the COVID-19 pandemic?*

Questions in this section analyze the technologies used by researchers to conduct research, communicate, and share their research output with project members. The challenges research

collaborators (researchers and project managers) face in using the technologies during the COVID-19 pandemic are also discussed.

Q2: Research collaboration (home) environment: *How is working from home helping or hindering a researcher collaborator's ability to collaborate with partners during the COVID-19 pandemic?*

Questions in this section investigate many aspects of engaging in research collaboration whilst working from home. For example, how working from home affects the mobility of the researchers, the distractions they face, Internet connectivity problems, etc.

The two sections and questions are part of an online survey questionnaire targeting Global North and South researchers and project managers. The structure of the questionnaire is summarized in Table 1, with the questions shortened. How each of the sections is used in this study is described in the authors' analysis framework (Figure 2). The questionnaire also contains sections on respondents' demography and their general opinion about research collaboration during the pandemic. The online survey ran for about 3.5 months (January 15, 2021 to April 30, 2021).

Table 1. Structure of the online survey questionnaire

Sections	Questions	Where Used in the Paper
Section 1: Demography	Q1. In which country do you currently reside? Q2. Which of the following includes your age? Q3. What is your gender? Q4. What is your profession? Q5. What is your research area or field of study? Q6. Where do you work? Q7. Which of the following is your Cluster of Excellence? Q8. Are you currently involved in a research project? Q9. Which of the following is true about your research project? If the answer to this question is "Yes," then respondents are asked about the status of their research project. Q10. Where are the majority of your project partners based?	Demographic characteristics of the participants, Table 2, and Discussion section See Figure 4 for the status of the research projects if the answer to Q9 is "Yes."
Section 2: Use of ICT during the COVID-19 pandemic	Q11. <i>How has the COVID-19 pandemic impacted your use of the following technologies?</i> Q12. Which of the following describes the technological challenges you encountered? Q13. How many meetings relating to your research did you attend during the last six months Q14. <i>Which of the following platforms are you using to collaborate with your colleagues?</i> Q15. <i>Which of the following cloud storage services are you using to share your research?</i>	Table 3, and Discussion section.
Section 3: Working From Home (Remotely) During the COVID-19 Pandemic	Q16. Are you working from home? Q17. How many countries have you visited during the last six months? Q18. <i>How has the following affected your ability to work from home?</i> Q19. <i>Rank the following from most distracting to not distracting when you work from home.</i>	Section 4.2, Table 4, and Discussion section.
Section 4: General Opinion About the COVID-19 Pandemic	Q20. <i>How has the pandemic lockdown affected your research collaboration?</i> Q21. Would you like to continue working from home after the lockdown? Q22. <i>Which of the following applies to you during the lockdown?</i> Q23. <i>Please summarize any opinion you would like to share about how the COVID-19 pandemic is impacting your research collaboration.</i>	Opinion section, Table 5, Table 6, and Discussion section.
End of Survey	Q24. Would you like us to share the survey data/results with you?	

BACKGROUND AND RELATED WORK

Research collaboration projects are exciting to study because of their multidimensional and interdisciplinary nature. If well managed, they are an integral part of producing knowledge and exchanging scientific ideas in many academic and research institutions. According to Sowe et al. (2021), a research collaboration project consists of partners locally situated within a country (Germany or Nigeria), region (Europe or Africa), or across regions such as the Global North and South projects studied in this paper. Researchers work together, often in a project, to achieve a common goal of addressing research questions about their study or producing new scientific knowledge about their region. The motivation for managing and/or taking part in a research collaboration project can be either intrinsic or extrinsic, or a mixture of both. Anecdotal and empirical evidence pointed out that research collaboration can increase scientific productivity, improve the quality of research, create a collective knowledge base (Sowe et al., 2008), lead to the internationalization of science and technology, increase the mobility of scientists across borders (Zaer et al., 2020), boost local research capacities (Minasny et al., 2020) and expertise, create new or upgrade existing research infrastructure for some partners, and help collaborators build interpersonal relationships (Freeth & Vilsmaier, 2020), which can be vital for future collaboration. Furthermore, when research collaboration encourages trust and openness (Lee & Haupt, 2021) between partners and institutions, it can become an essential tool for supporting interdisciplinary research in the humanities or even fostering academia-industry collaboration.

Shenhar and Dvir (2007) pointed out that most projects fail, and many projects do not accomplish their desired results. Could the statistics be different for North-South research collaboration projects? Is the COVID-19 pandemic just going to augment the failure statistics? Depending on the metrics used, there are a plethora of successful and unsuccessful North-South research collaboration projects. However, what is and what is not a successful research collaboration project is difficult to measure or evaluate. Many researchers measure the success of research collaboration using bibliographic data (Lee & Haupt, 2021). The premise of this measure is that the more papers the collaborators co-publish, the more successful is the collaboration project. Sowe et al. (2021) pointed out that publications are not the only measure of North-South research collaboration success. The researchers argued that metrics like the number of joint conferences, workshops, seminars, exhibitions/festivals organized by the collaborators, the number of research visits, or cultural exchanges undertaken by project partners are all measures of successful collaboration. The timely disbursement of funds cited by Porter and Birdi (2018) can also affect the execution of project milestones. Socio-cultural misunderstanding, conflicting ideas or approaches to a topic, and individual researcher's competence (Maina-Ahlberg et al., 1997), can all be barriers to successful international research collaboration, especially between researchers in the Global North and South.

Furthermore, Gaillard (1994) reported in his study that the dominance of the Northern partners could be an obstacle to implementing a successful research North-South collaboration project. This dominance or imbalance is synonymous with what Minasny et al. (2020) called "Helicopter research." During helicopter research, researchers from the Global North fly to the Global South, collect research data, fly out, analyze the data, and publish the results with little involvement from local scientists in the South. Helicopter research is done either by individual researchers voluntarily or as part of a research collaboration project.

The mobility restrictions imposed by the COVID-19 pandemic and the effect this is having on conventional work practices (Sein, 2020) means that research collaboration is only effectively possible because of collaboration and coordination technologies and the fact that researchers can work online and from home (Sowe et al., 2021). Many studies, for example (Grasenick & Guerrero (2020) and Rogers (2020), found that researchers are using various technologies to help them cope with the pandemic and continue their research. For project managers in general the New Normal is, most of the time, characterized by online video meetings, document sharing, the use of messaging platforms, and non-stop Zoom calls.

Research Collaboration During the Pandemic

Apart from ushering in new communication and collaboration challenges, the COVID-19 pandemic also provides a unique opportunity for researchers to understand the dynamics of research collaboration projects and engage with research collaborators in new ways. For instance, Lee and Haupt (2021) report that during the COVID-19 pandemic, countries with lower Gross Domestic Product (GDP) tend to participate more in open-access scientific publications than their counterparts in countries with higher GDP. The Mawazo Institute Survey Report, (Mawazo Institute, 2020), found that 72.5% of respondents suspended their lab research because of the COVID-19 pandemic. Impacted by the pandemic and with partners working remotely throughout the globe, Mummery (2020) described how the Inclusive Digital Engagement initiative of the Human Brain Project is helping scientists from different parts of the world collaborate during the pandemic. Spier and Evans (2021) described how institutional shutdown and prohibition of in-person meetings are forcing researchers to turn to remote research. The authors conjectured that many organizational changes such as online meetings implemented to help researchers cope with the pandemic might remain in the future. Zaer et al. (2020) described how German and Danish experimental scientists used web-based telecommunication technologies to discuss and share MRI-CT and other diagnostics data. Furthermore, in response to the impact of the COVID-19 pandemic, the International Labor Organization launched the South-South and Triangular Cooperation initiative targeting 75 countries in the Global South. One of the major prerequisites that project applicants must satisfy is the provision of knowledge exchange and a virtual meeting platform for collaboration and coordination of research during the pandemic.

Thus, researchers from both the Global North and South who can access and use the Internet and collaboration technologies to remotely *talk* to collaborators whilst working from home are immensely advantaged during the COVID-19 pandemic. Conversely, research collaboration will be impacted for researchers lacking affordable and stable Internet access at home, especially in the Global South (Duek & Fliss, 2020).

METHODOLOGY

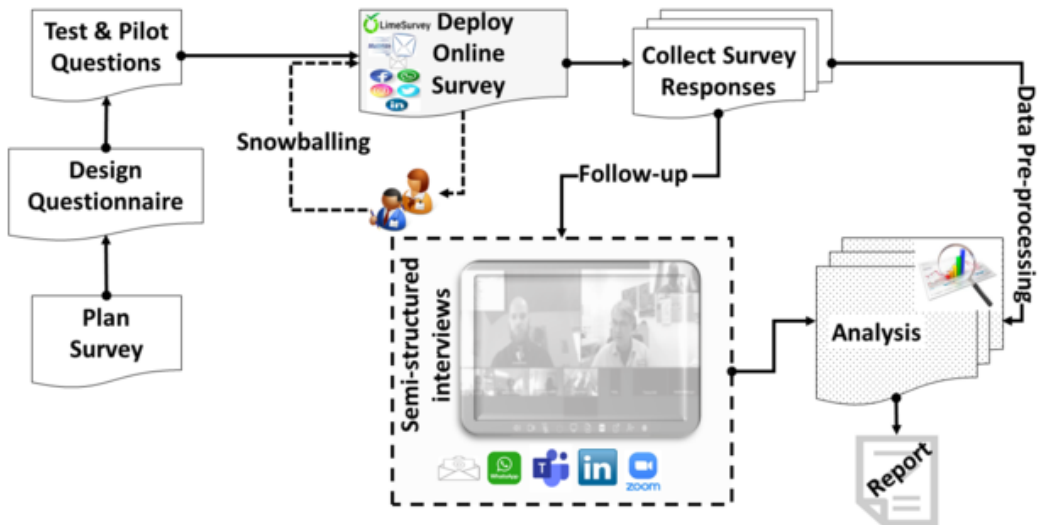
Figure 1 shows the methodology used to collect the data needed to study the impact of the COVID-19 pandemic for North-South research collaboration projects. The methodology was divided into three stages:

- **Preparation:** During the preparatory stage, the authors carried out a series of brainstorming sessions to discuss the types of questions to ask, under what sections the questions should appear, and the logic needed to redirect respondents. After a series of sketches, the lead author designed the survey questionnaire using LimeSurvey (LimeSurvey, 2020). The questionnaire was then tested and piloted with a small group of researchers, principal investigators, and project managers. After addressing the feedback from the pilot group, the authors modified and deployed the survey online. Some of the feedback included removing the mandatory option for some of the questions. The finalized questionnaire contained 24 questions spread across four sections, which are presented in Table 1.
- **Deployment:** The survey was freely hosted by a LimeSurvey consulting company. The survey was in open-access mode, which means that participants could freely access the survey by clicking the link sent to them. Snowballing technique was used to ask potential respondents to send the survey link to their colleagues who may be interested in the survey topic. One advantage of this technique is the multiplier effect which allows the person who receives the survey link to nominate two or more others. Participation in the survey was not mandatory but based on availability and willingness to take part. The survey was sent to various mailing lists, social media channels,

and selected research networks. During the follow-ups, participants were contacted via Zoom, Microsoft Teams, and WhatsApp to discuss their responses.

- **Data, Pre-processing, and Analysis:** The survey data was downloaded from the Limesurvey MySQL database and exported as CSV for analysis using the R statistical and Data Analysis software (R Core Team, 2020). Data preprocessing included converting questions into coded variables and removing incomplete answers that did not contain the information needed to answer the research questions.

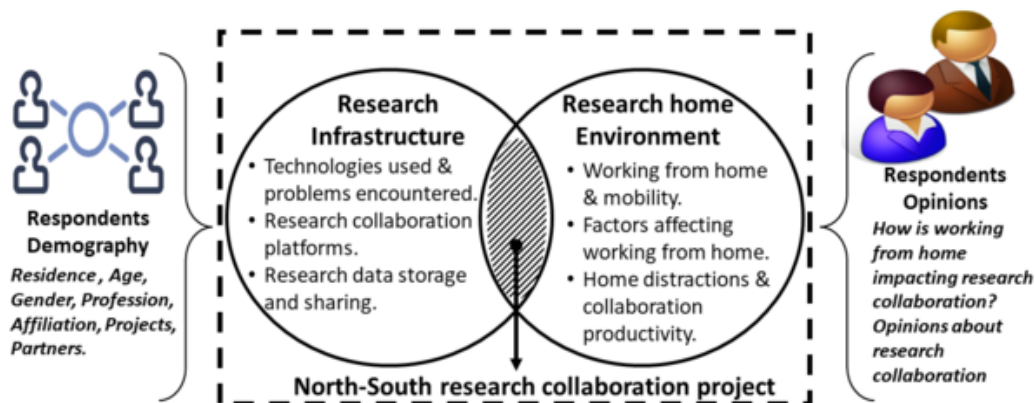
Figure 1. North-South research collaboration projects data collection methodology



RESULTS AND ANALYSIS

Figure 2 shows the analytical framework used in this research. As sketched, various qualitative and quantitative metrics were used to analyze responses to the questions in the questionnaire. The analysis began with a description of the demographic characteristics of the respondents. The research collaboration infrastructure and the research collaboration (home) environment sections were then analyzed and used to answer the research questions. The analysis proceeded with an exposition of respondents' opinions about research collaboration during the pandemic. Information obtained during the semi-structured follow-up interviews (Figure 1) was also analyzed and used to enrich the analysis.

Figure 2. Framework for analyzing research collaboration projects during the pandemic



Qualitative and Quantitative Metrics

For the respondents' demographic and opinions sections shown in Figure 2, the authors used central tendency measures (mean or average and standard deviation) to test and measure the normality of the distribution of the data. For each variable (e.g. residence, age, gender), they reported the values in percentages and the total population (n). The mean shows the average number of participants from each region (Global North or Global South) that answered a given question. The standard deviation measures how the answers are distributed or spread around the mean of that question. The analysis proceeds as follows.

First, the data needed to answer the research questions was split into two samples: one dataset with participants from the Global North and the other with participants from the Global South. Respondents were grouped based on their answers to the question, "Where do you work?" Workplace grouping was chosen because the demographic data showed that over three-quarters of the respondents worked at a Cluster of Excellence ($> 70\%$ in the Global North and $> 20\%$ in the Global South). The participants were independent because they could only choose one region (Global North or Global South) in the survey. In the analysis, the differences (if any) between responses from the participants in the two regions were then shown and discussed.

Second, given that the research questions motivate the authors to compare how the survey participants from each region responded (on average) to each question, the Mann-Whitney U Test, sometimes called the Wilcoxon Rank Sum Test, was chosen as the preferred analysis method. An independent non-parametric t -test is a special kind of Mann-Whitney U Test, which was used to compare the means of the two samples. This analysis method was suitable for this study because the survey participants were independent of each other. Furthermore, the demographic characteristics of the participants showed that the two datasets were skewed and had outliers. By interpreting the non-parametric t -test statistics, readers can understand the performance of the two groups based on a given (dependent) variable much better. The Mann-Whitney U Test also produced the p -value to help the authors infer whether the survey participants answered a question differently or what the probability was that all the participants would have given the same answer to a question. The p -value further helped the authors compare the two groups to see whether there was any statistically significant evidence to tell them why the respondents answered the questions differently.

How to Interpret the Statistics and Read the Tables

Tables 3-5 depict the mean values, standard deviation, and p -values. The mean values in the tables are different for different scales (Yes/No, Likert scale choices) used in the questions. A footnote

below each table describes these values and their abbreviations. For example, gS = Global South, $Mean_gN$ = the mean value of the data from the Global North, and Std_gS = the standard deviation of the data from Global South respondents. The *p-value or probability* value is like a percentage and ranges from zero to one. If the value is zero, there is no chance that the observation is valid, and the opposite is true when it is more than zero. The significance of the *p-values* is indicated with an asterisk in the tables. One asterisk (*) signifies a level of significance where $p < 0.5$ (50% chance). Two asterisks (**) are where $p < 0.01$ (1% chance).

For example, in one of the survey questions in Table 3, row 2, participants were asked to indicate how the COVID-19 pandemic impacted their use of WhatsApp. The Scale1† besides this question (explained in the footnote below the table) means that participants could enter one in their answer if their use of WhatsApp increased during the pandemic. Entering zero meant that their use of WhatsApp remained the same as before the pandemic, and Enter -1 if their WhatsApp uses decreased during the pandemic. Of the participants, 87 people answered this question ($n = 87$). To understand this data in the table, proceed thusly:

- First, reading from left to right for the Global South, out of a population (n) of 87 people who answered this question, 31 were from the Global South ($n = 31$). The mean ($Mean_gS$) or average answer to this question from the people from the Global South was 0.8065, and the standard deviation (Std_gS) was 0.4016.
- Second, reading from left to right for the Global North, out of a population (n) of 87 people who answered this question, 56 were from the Global North ($n = 56$). The mean ($Mean_gS$) or average answer to this question from the people from the Global North was 0.3929, and the standard deviation (Std_gS) was 0.5284.
- Is there any significant difference in answers to this question between the two groups? The *p-value*, which is 0.000103** or 0.0103%, offers the best metric to answer this question. Two asterisks (**) signifies a *p-value of* $p < 0.01$ (1% chance). Therefore, this value means that there is a slight chance that the participants answered the question differently, which also means that one can say with 99% certainty, the COVID-19 pandemic has impacted the use of WhatsApp for people in both regions. Furthermore, Figure 5 shows that, overall, about 55.17% (48/87) of the people indicated that their use of WhatsApp increased during the pandemic.

Data Set

The survey was activated online on January 15, 2021. After three and one-half months, on April 30, 2021, 1320 responses (100 full + 1220 partial responses) were collected and analyzed. A partial response was created in the survey database whenever someone clicked the survey link and closed the window without completing the survey. A partial response could also contain data for one or more answered questions. A full response was recorded in the database whenever someone completed the mandatory questions and clicked the Submit Survey button.

Demographic Characteristics of the Participants

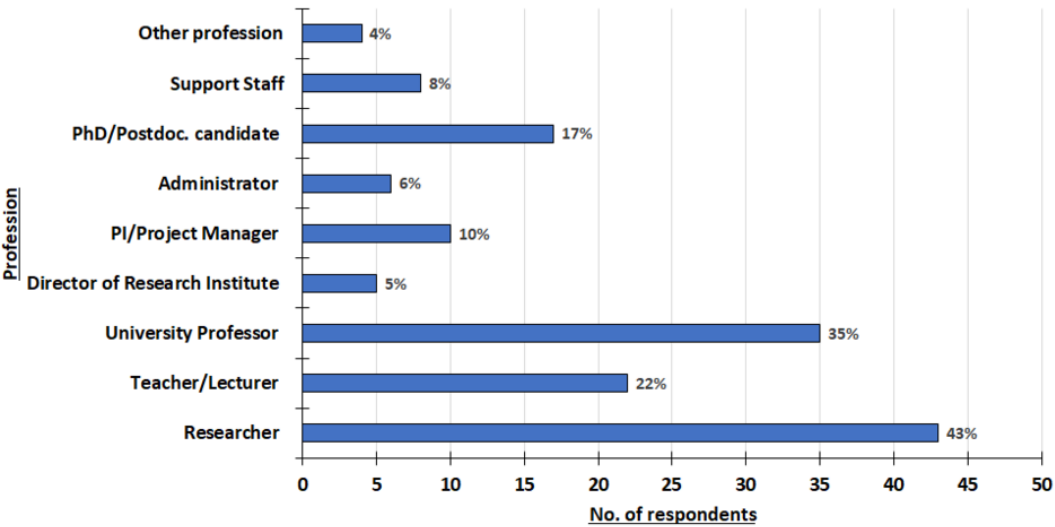
A total of 102 people, from 33 countries responded to the country of residence question. The mean number of respondents per country was 3.09 (Median = 2.00, Std. Deviation = 5.192). However, the country of residence data is skewed (Skewness = 4.672, Kurtosis = 24.002) because respondents from Germany and Nigeria alone accounted for more than one-third (38%) of all the respondents from the 33 countries. The Global North-South distribution of the countries, according to the Wikimedia 2021 regional classification of countries, is shown in Table 2.

Table 2. Global distribution of the respondents

Global North (N = 14)	Global South (N = 19)
Belgium, Canada, France, Germany, Greece, Italy, Japan, Netherlands, Norway, Sweden, Switzerland, Turkey, United Kingdom, United States	Bahrain, Benin, Brazil, Burkina, China, Costa Rica, Gambia, Ghana, Guinea, India, Indonesia, Kenya, Malawi, Nepal, Nigeria, Senegal, South Africa, Tanzania, Vietnam
Total Respondents = 64	Total Respondents = 38

In terms of age, most of the respondents (30%) were in the 35-44 years of age range. No one was 75 years and older. The percentage of respondents in the other age ranges were as follows: 18-24 years = 1%, 25-34 years = 17%, 45-54 years = 28%, 55-64 years = 19%, and 65-74 years = 5%. The gender distribution was 54% male and 42% female. As shown in Figure 3, nearly half of the respondents were researchers (43%), followed by 35% of the respondents who categorize themselves as university professors. Teachers and lecturers (22%), and doctoral and postdoctoral candidates (17%) were the third and fourth largest professions. Of respondents, 4% indicated that they belonged to another profession not captured by the survey. Principal investigators (PIs) and research collaboration project managers account for 10% of the population studied.

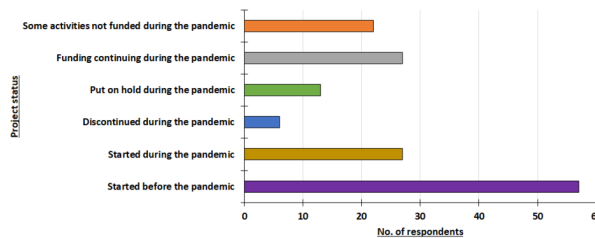
Figure 3. Demographic characteristics of the participants by profession



When asked about their research area or field of study, more than half (53%) of the respondents indicated that they were specializing in the social sciences and humanities, and 16% indicated that they were specializing in computer science and information technology. Additionally, 4% of the respondents were specializing in each of the following fields: Business and management, education, media and communications, environmental, agricultural, and physical sciences. Of respondents, 60% worked in the public sector, 9% in the private sector, 5% in the nonprofit sector, and over three-quarters were affiliated with a Cluster of Excellence. The Clusters of Excellence are funded by the Germany Excellence Strategy (DFG). With the latter affiliation, about 72% of the respondents were working in Clusters of Excellence located in the Global North while the remaining participants (19.4%) were working in Clusters of Excellence located in the Global South.

Figure 4 shows that 80% of the respondents were already involved in a research project when the survey was administered, and 37.5% (N = 57) reported that their research project started before the pandemic. Funding was continuing for 17.8% of the respondents. However, for those with projects running during the pandemic, 15.5% reported that some project activities (e.g., meetings, conferences, workshops, field trips) were not funded. While 17.8% were able to acquire funding for new research projects, 8.6% had their projects put on hold or discontinued (3.9%) during the pandemic. When asked about where (Global North or South) the majority of their project's partners were located, about 40% indicated that their partners were in the Global South (Africa), more than one-third (35.06%) indicated that their partners were in the Global North (Western Europe), and 19% indicated that their partners were equally distributed between the Global North and South.

Figure 4. Status of research projects before and during the pandemic



Research Collaboration Infrastructure

What communication and coordination technologies are North-South research collaborating using to help them collaborate with their partners during the COVID-19 pandemic?

In the survey, participants indicated that their use of Zoom, WhatsApp, Microsoft Teams, Cisco Webex, and Skype has significantly ($p < 0.05$, 2-tailed) increased during the COVID-19 pandemic. Other technologies not included in the survey also registered an increase in use during the pandemic. For example, as indicated by respondent ID108 from the Global South, WeChat is another research collaboration platform commonly used in China. However, as shown in Figure 5 and Table 3, there is a significant difference in the way North-South research collaborators use WhatsApp ($p = 0.000103^{**}$), Skype ($p = 0.000268^{**}$), and Google Meet, previously called Google Hangouts Meet ($p = 0.013286^{*}$). Since the use of Zoom has increased 100% during the pandemic for all the survey participants, a t -test was not possible for this item.

Figure 5. Technologies used to support research collaboration during the pandemic

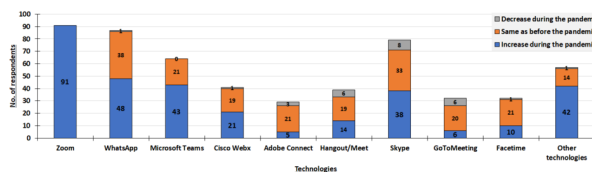


Table 3. Comparative analysis of the North-South research infrastructure questions (the table has three blocks)

Answer Options	n	Mean_gS	Mean_gN	Std._gS	Std._gN	p-value
<i>Q11. How has the COVID-19 pandemic impacted your use of the following technologies? Scale1†</i>						
WhatsApp	87	0.8065(n=31)	0.3929(n=56)	0.4016	0.5284	0.000103**
Microsoft Teams	64	0.7895(n=19)	0.6222(n=45)	0.4189	0.4903	0.173736
Cisco Webx	41	0.5000(n=6)	0.4857(n=35)	0.5477	0.5621	0.954770
Adobe Connect	29	0.0000(n=5)	0.0833(n=24)	0.7071	0.5036	0.812320
Hangout/Meet	39	0.5714(n=14)	0.0000(n=25)	0.6462	0.6455	0.013286*
Skype	79	0.7391(n=23)	0.2321(n=56)	0.4490	0.6873	0.000268**
GoToMeeting	32	0.0000(n=6)	0.0000(n=26)	0.8944	0.5657	1.000000
Facetime	33	0.4286(n=7)	0.2308(n=26)	0.5345	0.5144	0.403290
Other Technologies	57	0.7368(n=19)	0.7105(n=38)	0.5620	0.4596	0.860914
<i>Q14. Which of the following platforms are you using to collaborate with your colleagues? Scale2‡</i>						
Twitter	100	0.2059(n=34)	0.1515(n=66)	0.4104	0.3613	0.516272
LinkedIn	100	0.2647(n=34)	0.2879(n=66)	0.4478	0.4562	0.808305
Facebook	100	0.2941(n=34)	0.2727(n=66)	0.4625	0.4488	0.825553
ResearchGate	100	0.3824(n=34)	0.3485(n=66)	0.4933	0.4801	0.743817
Instagram	100	0.0294(n=34)	0.0152(n=66)	0.1715	0.1231	0.668271
Google Scholar	100	0.4118(n=34)	0.2424(n=66)	0.4996	0.4318	0.098339
YouTube	100	0.1176(n=34)	0.0909(n=66)	0.3270	0.2897	0.688884
Other Platforms	100	0.4412(n=34)	0.5303(n=66)	0.5040	0.5029	0.404846
<i>Q15. Which of the following cloud storage services are you using to share your research? Scale2</i>						
Google Drive	100	0.7647(n=34)	0.5303(n=66)	0.4306	0.5029	0.017324*
MS OneDrive	100	0.2059(n=34)	0.2121(n=66)	0.4104	0.4119	0.942882
iCloud Drive	100	0.0882(n=34)	0.1061(n=66)	0.2879	0.3103	0.776042
Drop Box	100	0.4412(n=34)	0.5758(n=66)	0.5040	0.4980	0.208525
Live Drive	100	0.0000(n=34)	0.0000(n=66)	0.0000	0.0000	NA
OneDrive	100	0.1471(n=34)	0.1212(n=66)	0.3595	0.3289	0.727200
Box	100	0.0294(n=34)	0.0758(n=66)	0.1715	0.2666	0.295698
Zoolz	100	0.0000(n=34)	0.0000(n=66)	0.0000	0.0000	NA
Amazon Drive	100	0.0294(n=34)	0.0303(n=66)	0.1715	0.1727	0.980480
Nextcloud	100	0.0000(n=34)	0.0303(n=66)	0.0000	0.1727	0.158878
Bespoke solution	100	0.0882(n=34)	0.1364(n=66)	0.2879	0.3458	0.462550
Other Cloud Storage	100	0.2353(n=34)	0.3788(n=66)	0.4306	0.4888	0.136160

Note: Each block represents a survey question (Table 1) and answer options (first column) for that question. The headings of the remaining six columns apply to all the blocks.)

n = number of respondents, *gS* = Global South, *gN* = Global North.

* Significant at $p < 0.05$; ** significant at $p < 0.01$.

†Scale 1 = Increase during the pandemic (1),

Same as before the pandemic (0),

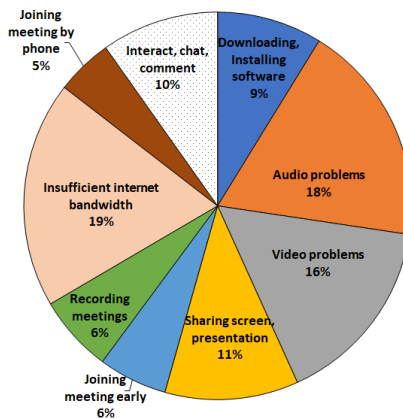
Decrease during the pandemic (-1).

‡Scale 2 = Yes (1), No (0)

Six months before completing this survey, respondents had, on average, 44.76 online meetings using a computer, laptop, or tablet ($N = 90$, Std. Dev. = 32.38) and 14.2 online meetings ($N = 90$,

Std. Dev. = 17.36) using telephone or mobile. During these online meetings, users encountered numerous challenges (Figure 6). For instance, 19% of the people surveyed reported low bandwidth and insufficient Internet connection problems. In addition, audio and video quality problems were reported by 18% and 16% of the respondents, respectively. There were no significant differences ($p = 0.407634$) in these challenges between the Global South (gS) and North (gN) groups, although respondents from the two groups answered differently. For example, for the Internet connection and insufficient Internet bandwidth problem, the values were mean $gS = 0.6176$ ($n = 34$), Std. $gS = 0.4933$ and mean $gN = 0.5303$ ($n = 66$), and Std. $gN = 0.5029$.

Figure 6. Problems encountered by research collaborators during online meetings



When asked to indicate the platforms they were using to collaborate with their colleague, most of the respondents chose other collaboration platforms not represented in the survey. However, ResearchGate, Google Scholar, Facebook, and LinkedIn were also popular platforms among respondents. As shown in Table 3, the cloud storage services for sharing research data are dominated by Google Drive (mean $gS = 0.7647$ ($n = 34$), Std. $gS = 0.4306$ and mean $gN = 0.5303$ ($n = 66$), and Std. $gN = 0.5029$), and there is a significant difference ($p = 0.017324^*$) in the use of this service by research collaborators in the North and South. Drop Box is the second preferred cloud storage for sharing research data (mean $gS = 0.4412$ ($n = 34$), Std. $gS = 0.5040$ and mean $gN = 0.5758$ ($n = 66$), and Std. $gN = 0.4980$). None of the respondents selected LiveDrive and Zoolz, but other cloud storage services (mean $gS = 0.2353$ ($n = 34$), Std. $gS = 0.4306$ and mean $gN = 0.3788$ ($n = 66$), and Std. $gN = 0.4888$) were also commonly used by the collaborators.

Research Collaboration (Home) Environment

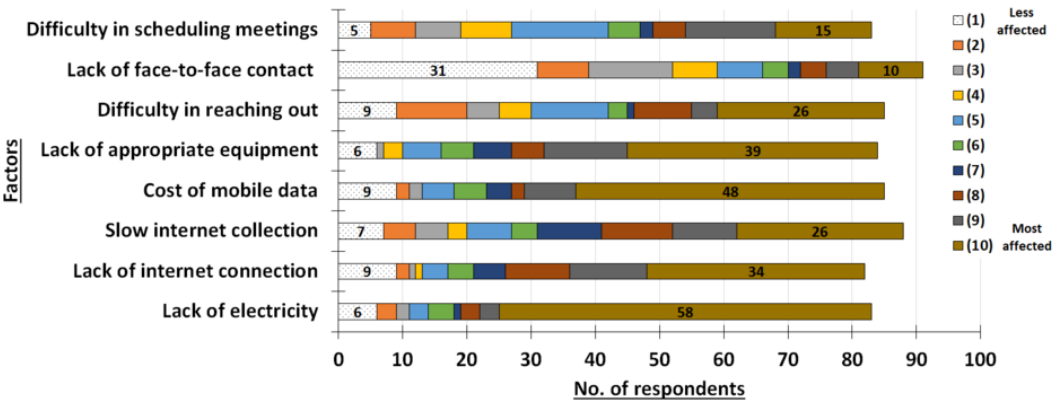
How is working from home helping or hindering a researcher collaborator's ability to collaborate with partners during the COVID-19 pandemic?

Many people are slowly getting used to working from home during the pandemic. Of respondents, 85% of those surveyed answered the "Are you working from home?" question in the affirmative, and 10% were working from home, but sometimes went to their offices to work on their research projects. The average number of countries visited by the respondents was 1.11 (Std. Dev. = 0.89), and the maximum number of countries visited by one individual from the Global North was four. When asked to rank the factors affecting their ability to work from home, participants from both the

Global North and South reported that the most significant effect (of the lockdown) was the lack of direct face-to-face contact with colleagues (Figure 7 and Table 4). Researchers also had difficulty contacting research partners and scheduling meetings when working from home.

Furthermore, when asked to rank what distracted them most when working from home, most people reported that children were the most distracting. Distractions from phone calls and messaging and other forms of distractions not captured in the survey also ranked high amongst the respondents. Table 4 shows that there was a significant difference between the way people from the Global South and Global North ranked distractions from neighbors ($p = 0.001066^{**}$), TV, and Radio ($p = 0.009073^{**}$)

Figure 7. Factors affecting research collaboration when working from home



Opinions: Research Collaboration During the Pandemic

Figure 8 shows that the most notable impact of the lockdown was on local and international events such as meetings, workshops, or conferences. Table 5 represents a comparative analysis of opinions from Global North and South research collaborators. Perhaps this explains why survey participants cited the lack of face-to-face contact with colleagues as the most significant impact of the lockdown. This impact is not surprising because face-to-face contacts are a common occurrence at pre-pandemic local and international events. In addition to international and local events, the lockdown also affected people involved in laboratory and fieldwork. Table 5 shows that even though a different number of people answered this question, there was no significant difference between the Global North and South (mean $gS = 2.1923$ ($n = 26$), mean $gN = 2.2364$ ($n = 55$)).

Table 4. Comparative analysis of the North-South research environment questions

Answer Options	n	Mean_gS	Mean_gN	Std._gS	Std._gN	p-value
<i>Q18. How has the following affected your ability to work from home? Scale^{1†}</i>						
Lack of electricity	83	6.5357 (n=28)	9.3091 (n=55)	3.5117	2.1246	0.000465**
Lack of Internet connection	82	6.1379(n=29)	8.4717(n=53)	3.5023	2.4147	0.002610**
Slow Internet connection	88	6.1379 (n=29)	7.3390 (n=59)	3.3777	2.7954	0.104270
Cost of mobile data	85	6.0323 (n=31)	8.9444 (n=54)	3.7012	2.1841	0.000251**
Lack of appropriate equipment (laptop)	84	7.4074(n=27)	8.2456(n=57)	3.2730	2.4074	0.242156

Table 4 continued on next page

Table 4 continued

Answer Options	n	Mean_gS	Mean_gN	Std._gS	Std._gN	p-value
Contacting colleagues is difficult	85	5.6429(n=28)	6.3333(n=57)	3.7438	3.2146	0.407271
Lack of direct contact with colleagues	91	4.0690(n=29)	3.9677(n=62)	3.2506	3.1828	0.889704
Difficulty in scheduling meetings	83	5.9630(n=27)	6.1786(n=56)	3.1068	2.9610	0.764895
<i>Q19. Rank the following from most distracting to not distracting when you work from home. Scale^{†‡}</i>						
Children	78	5.4138(n=29)	6.0204(n=49)	3.5809	3.8541	0.484876
Neighbors	78	5.5455(n=22)	8.5536(n=56)	3.5554	2.5220	0.001066**
Other family members (siblings)	85	5.4286(n=28)	6.9825(n=57)	3.8145	3.2265	0.070051
TV/Radio	83	6.4286(n=28)	8.3818(n=55)	3.2481	2.7588	0.009073**
Phone Calls/Messaging	86	5.4138(n=29)	6.5439(n=57)	3.0650	3.1286	0.113944
Other Distractions	69	4.7778(n=18)	6.1765(n=51)	3.4735	3.1730	0.144544

Note: (The table has two blocks. Each block represents a survey question (Table 1) and answer options (first column) for that question. The headings of the remaining six columns apply to both blocks.)

n = number of respondents, gS = Global South, gN= Global North.

*Significant at $p < 0.05$; **significant at $p < 0.01$.

†Scale 1 = Most affected (1), Less affected (10).

‡Scale 2 = Most distracting (1), Less distracting (10)

Figure 8. Effect of the pandemic on some aspects of research collaboration

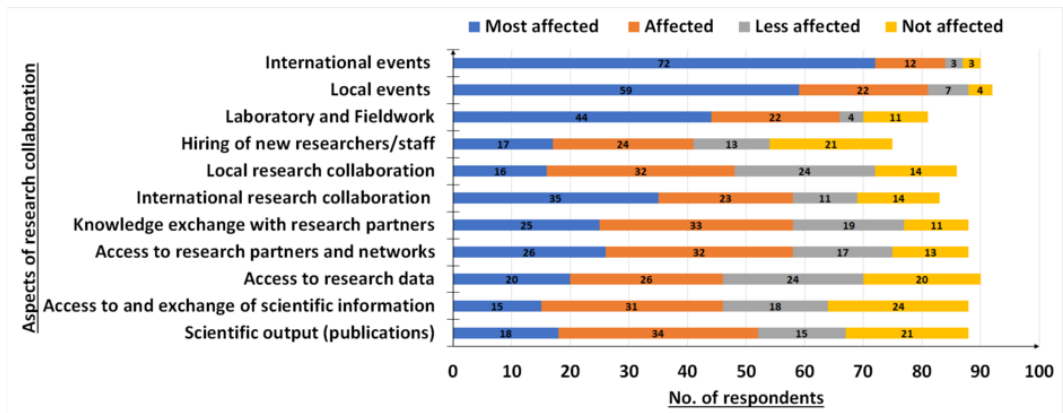


Table 5. Comparative analysis of North-South research collaborators' opinions

Answer Options	n	Mean_gS	Mean_gN	Std._gS	Std._gN	p-value
<i>Q20. How has the pandemic lockdown affected your research collaboration? Scale^{1†}</i>						
Scientific output (publications)	88	1.4643(n=28)	1.6000(n=60)	1.2013	1.0118	0.606861
Access/exchange of scientific information	88	1.4286(n=28)	1.4167(n=60)	1.1031	1.0623	0.962136
Access to research data	90	1.5667(n=30)	1.4833(n=60)	1.0400	1.0969	0.726189
Access to research partners/networks	88	1.8214(n=28)	1.8000(n=60)	0.9833	1.0544	0.926215
Knowledge exchange with partners	88	1.8966(n=29)	1.7797(n=59)	0.9002	1.0350	0.588071
International collaboration (Africa-EU)	83	1.9630(n=27)	1.9464(n=56)	1.0913	1.1349	0.949346
Local collaboration (same country)	86	1.7241(n=29)	1.5088(n=57)	1.0986	0.9087	0.367771
Hire new researchers/staff	75	1.6538(n=26)	1.4082(n=49)	1.0561	1.1712	0.360111
Laboratory and fieldwork	81	2.1923(n=26)	2.2364(n=55)	0.9806	1.0880	0.856155
Local events (Meetings, workshops)	92	2.2667(n=30)	2.5806(n=62)	0.9072	0.7585	0.107655
International events (Meetings, workshops)	90	2.7241(n=29)	2.6885(n=61)	0.6490	0.7197	0.815196
<i>Q22. Which of the following applies to you during the lockdown? Scale 2‡</i>						
I feel more productive	95	0.4062(n=32)	-0.1111(n=63)	0.7976	0.8252	0.004385**
I lost contact with research colleagues	92	0.0667(n=30)	0.3065(n=62)	0.8277	0.8606	0.203513
Sometimes I feel depressed	94	-0.0323(n=31)	0.3175(n=63)	0.9481	0.8391	0.086734
Sometimes difficult scheduling my work	94	0.3125(n=32)	0.2419(n=62)	0.8206	0.8812	0.701356
Looking forward to the end of the lockdown	94	0.6333(n=30)	0.8906(n=64)	0.6687	0.3615	0.055559
Sometimes I have face-to-face meetings	91	0.4667(n=30)	-0.0328(n=61)	0.8604	0.9481	0.014430*
I attracted/joined a new research project	88	0.0000(n=28)	-0.0833(n=60)	0.9027	0.9441	0.692550
I have learned a new set of skills or technology	90	0.6552(n=29)	0.6885(n=61)	0.6695	0.6962	0.828196
I experienced (electricity) power outage	91	0.3000(n=30)	-0.5738(n=61)	0.8769	0.7844	0.000025**
I experienced Internet shutdown	91	0.1613(n=31)	-0.2167(n=60)	0.9344	0.9405	0.072941
I feel less productive	92	-0.3448(n=29)	-0.1429(n=63)	0.8567	0.8203	0.291924

Note: (The table has two blocks. Each block represents a survey question (Table 1) and answer options (first column) for that question. The headings of the remaining six columns apply to both blocks.)

n = number of respondents, gS = Global South, gN = Global North.

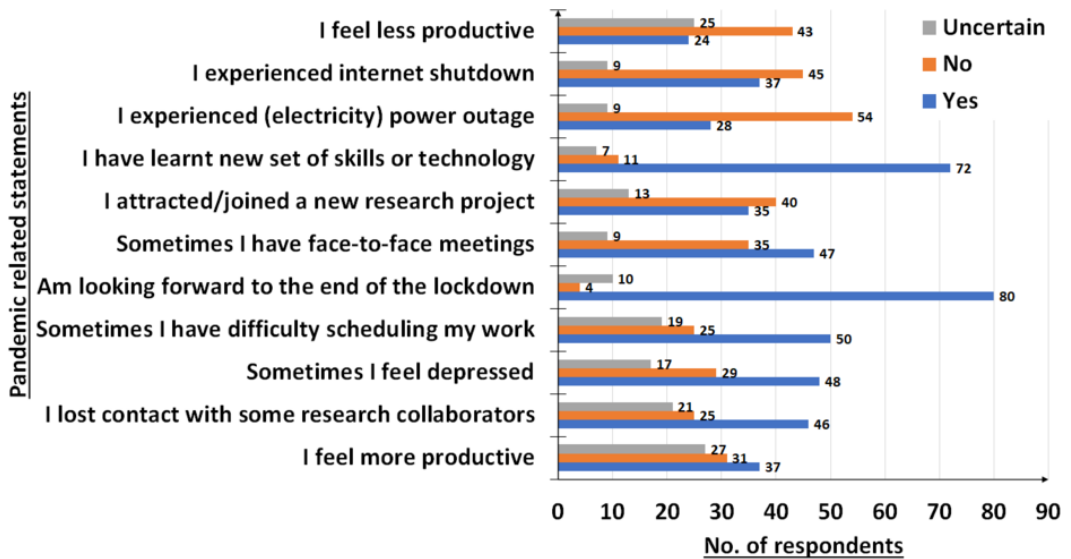
*Significant at $p < 0.05$; ** significant at $p < 0.01$.

†Scale 1 = Most affected (3), Affected (2), Less Affected (1), Not affected (0).

‡Scale 2 = Yes (1), Uncertain (0), No (-1)

When asked whether they would like to continue working from home after the lockdown, 34% of the respondents answered in the affirmative, 31% said “No,” and 29% were undecided. As shown in Table 5, while most of the respondents were looking forward to the end of the lockdown, a sizable number (mean $gS = 0.6552$ ($n = 29$), mean $gN = 0.6885$ ($n = 61$)) of them also learned a new set of skills or technologies during this period. Furthermore, a comparative analysis of how people from the Global North and South responded to these statements revealed a significant difference. For instance, as indicated by the mean $gN = -0.1111$ and $p = 0.004385^{**}$ values in Table 5, while 67.2% of the respondents from the South felt more productive during the lockdown, their counterparts in the North felt otherwise. The reverse was true for “I feel less productive.” A significant number ($p = 0.014430^{*}$) of respondents from the Global South also answered, “Yes” to “Sometimes I have face-to-face meetings” than their Northern counterparts. They also significantly ($p = 0.000025^{**}$) experienced more electricity power outages during the lockdown. The “Yes,” “No,” and “Uncertain” responses to these statements are illustrated in Figure 9.

Figure 9. Which of the following statements applies to “you” during the lockdown?



The participants were further asked to share their opinions about how the COVID-19 pandemic was impacting them in their research collaboration projects. The survey generated 41 comments from the participants. Table 6 summarizes some of those comments, giving the participant’s location (Global North or South) and his/her ID in the survey database.

Table 6. Selected participants' comments (original comments were edited to remove typos)

Location/ID	Q23. Your opinion about how the pandemic is impacting your research collaboration
South/ID63	<i>"But for the pandemic, my team would have completed the fieldwork scheduled for September 2020. To avoid taking undue risks, we had to put the fieldwork on hold. But as it stands, we must commence in February, but we have to comply with all the non-pharmaceutical guidelines."</i>
North/ID304	<i>"It did not allow us to visit our research site and collaborate with researchers. Many funding is returned because we could not complete the task due to travel restrictions and other related issues."</i>
South/ID334	<i>"COVID 19 brings both advantages and disadvantages. I can work peacefully at home... meetings in Zoom... are possible—but it is difficult to discuss all the nuances of the research project."</i>
North/ID218	<i>"I have difficulty seeing the relevance of my work to the world in the current situation. Teaching is taking lots more time and my research output is suffering."</i>
South/ID533	<i>"It's been a boon to productivity. In the longer term, it will be great to retain a lot of the online interactions, while opening up travel and f2f meetings on a limited basis."</i>
North/ID94	<i>"I had to end my field research early and leave the country in which my fieldwork was conducted."</i>
South/ID211	<i>"COVID-19 has given us a new research area. Besides, we at least had sufficient time to complete writing our book chapters/papers."</i>
North/ID84	<i>"...it came with additional parental responsibilities. Homeschooling takes more time than my own teaching."</i>
North/ID370	<i>"I had organized a workshop which included people from South Africa coming to Europe. It's sad that it's not happening, but we are hoping to postpone, pending funding approval, control of the pandemic, and room in people's schedules."</i>

Opinions From Principal Investigators/Project Managers

The opinions of the 10% of the people who classified themselves as Principal Investigators/Project Managers in the demography analysis were not that much different from the rest of the studied cohort. Of respondents, 60% of them (50% males and 50% females) came from the South, whilst the other 40% were from the North, and 70% indicated that they were working from home in their own countries. At the time of completing this survey, 20% were working from home in another country, caught up by pandemic travel restrictions and 10% did not indicate their home location. Furthermore, 7 out of 10 had difficulty reaching out to research collaborators, making scheduling face-to-face meetings almost impossible. During the lockdown, 95% of the Investigators/Project Managers said that they have learned a new set of skills or technology to help them manage their research collaboration projects.

When asked whether they would like to continue working from home after the lockdown, more than half of them said "No." Most of the Principal Investigators/project managers indicated that managing international and local research collaboration was either "most affected" or "affected" by the pandemic. The group expressed that hiring new researchers, staff, or student assistants was less affected by the pandemic. Table 7 shows some comments the Principal Investigators/Project Managers made about how the COVID-19 pandemic was impacting their research collaboration projects.

Table 7. Comments from principal investigators/project managers (original comments were edited to remove typos)

Location/ID	Comments/Opinions
North/82	<i>"It (the pandemic) came with additional parental responsibilities. Homeschooling takes more time than my own teaching."</i>
South/174	<i>"Face-to-face meeting for a long period of time has become difficult. Scheduling meetings with colleagues have become challenging."</i>
North/1163	<i>"Overall, I'm able to meet with my collaborators, but it's not anywhere near as productive or fulfilling an experience. There's no sense of energy, no sense of collaborative discovery, and no excitement in the exchange like we might have face-to-face over coffee or in a shared workspace. It's just another thing to schedule and check off the To-Do list. I'm not excited about the research and I really just want to get it done and published. Basically, my research has become a chore that needs to get done rather than something I genuinely care about and want to do."</i>
South/356	<i>"Virtual classes consumed my time for research. More teaching time, more tiring, and not much time for project management"</i>

Limitations and Threats to the Validity of the Study

A dataset consisting of 102 participants spread across 33 countries was used to help the authors understand the nature of North-South research collaboration and how best to manage research projects during the COVID-19 pandemic. The authors would like to sound a note of caution when generalizing the findings from this study. In particular, the dataset used in this study was a small dataset and by no means representative of the entire Global North and South research collaboration population or projects. The dataset only consists of 64 respondents from 14 Northern countries and 38 respondents from 19 Southern countries. It was also mentioned that the country of residence data is skewed because respondents from Germany and Nigeria alone accounted for more than one-third of all the respondents from the 33 countries (ref. Table 2).

While the North-South research collaboration data collection methodology presented in Figure 1 gave the authors all the instruments needed to construct a good survey, the questionnaire was not able to capture some elements where the participants expressed strong opinions. For example, there was no way of knowing from the demographic data the profession of 4% of the people surveyed, the other technologies and platforms researchers were using to collaborate with their colleagues or the other forms of distractions research collaborators encountered when working from home.

DISCUSSION

Irrespective of the geographical location, the status of the research collaboration infrastructure (technology and platforms used to collaborate with colleagues and manage projects), and the research collaboration (home) environment, many researchers managed to continue working from home on their research collaboration projects that started before the pandemic. A small number (10%) of the researchers, PIs, and Project Managers (20%) were working from both home and office, but working from home did not mean that researchers were not mobile. On average, every respondent visited at least one country (mean = 1.11) during the pandemic. Some people in the Global North visited two or more (max. = 4) countries.

North-South Research Collaboration Infrastructure

As attested by Archibald et al. (2019), Sein (2020), and Zaer et al. (2020), the COVID-19 crisis has forced people to embrace collaboration and coordination technologies for working online and from home. Many studies, for instance, (Grasenick & Guerrero, 2020; Rogers, 2020; Zaer et al., 2020),

found that researchers are using various technologies to help them cope with the pandemic, continue their research, and manage their projects.

Interestingly about the research collaboration infrastructure (Table 5) is that not only did the use of some technologies increase, decrease, or stay the same during the pandemic, but the pandemic provided researchers from both the Global North and South the opportunity to learn a new set of skills or technologies. All the people surveyed indicated that their use of Zoom increased during the pandemic. Despite the challenges, videoconferencing software provided opportunities to connect and discuss research progress and project management issues with colleagues. As one Global South collaborator (South/ID334) commented in Table 6:

I can work peacefully at home... meetings in Zoom... are possible-but it is difficult to discuss all the nuances of the research project.

The increase in the use of Zoom and other videoconferencing technologies (WhatsApp, Microsoft Teams, Skype) during the pandemic there was also an increase in online meetings, which might, in turn, lead to what Rogers (2020) referred to as "Zoom fatigue." The authors cannot infer fatigue from our data, but the group studied had 44.76 online meetings using a computer, laptop, or tablet, and 14.2 online meetings using a telephone or mobile; meaning not a single working day goes by without a Zoom meeting. A paradox on the devices used for online meetings during the pandemic is that, according to the International Telecommunication Union statistics, the developing world (Global South) outnumbers the developed world (Global North) by 6:1 when it comes to mobile-cellular subscriptions. However, the analysis showed that during the same period, researchers in the Global North (e.g., Germany, Japan, United Kingdom, France, Japan) had twice as many online meetings using telephones or mobile phones as their counterparts in the Global South (Indonesia, Costa Rica, Nigeria).

The research collaboration infrastructure with all its associated challenges provides an opportunity for researchers to address some of the most pressing research collaboration and project management problems posed by the pandemic, such as the lack of face-to-face contact with colleagues and the difficulty in reaching out to research collaborators or project partners. Consequently, as argued by Duek and Fliss (2020), research collaboration (and the management of research projects) will be impacted for researchers or project managers lacking the appropriate infrastructure (e.g., affordable and stable Internet access), but will be enhanced for those who can access and use collaboration technologies to "talk" with collaborators whilst working from home during the COVID-19 pandemic.

In this study, the lack of or slow Internet connection, cost of mobile data, lack of electricity, and appropriate equipment, such as laptops or headphones for videoconferencing, are ranked high by researchers from the Global South. A stark contrast was observed in how the lack of electricity ($p = 0.000465^{**}$), Internet connection ($p = 0.002610^{**}$), and the cost of mobile data ($p = 0.000251^{**}$) affected researchers from the Global South to engage in research collaboration while working from home. Another notable highlight of this study is the cancellation or suspension of local and international events (e.g., meetings, workshops, conferences, fieldwork) because of travel restrictions. The highlight is lucidly captured in the comments made by some of the survey respondents in Table 6. For example, respondent South/ID63 commented that if it were not for the pandemic, his team would have completed the fieldwork they scheduled for September 2020. Respondent North/370 felt sad that the workshop he organized with South African and European partners did not take place because of the lockdown. Another participant (North/ID304) commented that the lockdown did not allow them to visit their research site and collaborate with other researchers.

In addition to using videoconferencing tools to support North-South research collaboration, researchers also used several social media and research platforms to collaborate with their colleagues. Table 3 shows that ResearchGate, Google Scholar, Facebook, and LinkedIn, in that order, were the most favored platforms by researchers from both the Global North and South. Cloud storage services

for sharing research data are dominated by Google Drive and DropBox, with 64% of the users coming from the Global North and 57.4% from the Global South.

North-South Research Collaboration (Home) Environment

Trying to stay focused while working from home has become the new normal for many people. In this study, researchers from both the North and South indicated that children, phone calls, and text messaging were the most distracting when they worked from home (see Table 4). Generally, results of the analysis also demonstrated that respondents from the North were less distracted by neighbors (mean $gN = 8.5536$ ($n = 56$), Std. $gN = 2.5220$, $p = 0.009073^{**}$), TV, and Radio (mean $gN = 8.3818$ ($n = 55$), Std. $gN = 2.7588$, $p = 0.009073^{**}$) than their counterparts in the South. Specifically, except for the participants from four countries in the Global South (South Africa, Nigeria, China, Costa Rica), all other participants who gave a rank of 10 (less distracting) to distractions from neighbors were from the Global North.

It was not only the case that the authors could not find consensus amongst the researchers when asked whether they would like to continue working from home after the lockdown (“Yes” = 34%, “No” = 31%, “Undecided” = 29%), but most of them (94%) said that they were looking forward to the end of the lockdown. Maybe the researchers in our dataset want the lockdown to end, but wish to continue working from home most of the time? In connection with this conjecture is the argument advanced by Spier and Evans (2021) that institutional shutdown and the prohibition of physical contact has forced researchers to turn to remote research because of some of the organizational changes (teleworking). Table 5 also lists other self-esteem and environmental factors that come into play when working from home during the pandemic. For instance, more than two-thirds (67.2%) of the respondents from the Global South felt more productive during the pandemic than their Northern counterparts.

CONCLUSION

In this paper, the authors presented an approach, a methodology, and a framework for studying the impact of the COVID-19 pandemic on North-South research collaboration. Their approach to the subject of this study was to group a series of questions from an online survey into two main sections. The first was the research collaboration infrastructure section, and the second was the research collaboration environment. The methodology shows how the authors planned, designed, piloted, and deployed the survey data collection instrument or questionnaire. An analytical framework was used as the background to explain how they applied an independent nonparametric *t-test* and other statistical measures to analyze the survey data consisting of 102 researchers coming from 33 different countries.

The results and discussion presented helped the authors understand the complex nature of research collaboration projects and how the pandemic has changed the way project managers used to manage research projects before the pandemic. In managing a research collaboration project, the project manager, sometimes also the Principal Investigator, is usually involved in several essential project management activities. The activities may include project planning and tracking, managing project resources (human and research material), estimating and calculating costs, schedule management (conference, research visits), and risk and communication management. Of course, for any project, research or otherwise, delays, inefficiencies, and rising costs can occur when executing any of the above activities. For many organizations, including Clusters of Excellence in Universities, problems associated with remote project management are not new. One female project manager contends that a project (research or otherwise) with the right tools, clear communication, and collaboration strategy can succeed. She highlighted two essential requirements for success were also revealed in this study:

- A project with the right technical equipment (computer, Internet connection, remote access to company software).

- A project in which most of the members have the right technical equipment (computer, Internet connection, remote access to software), and wherein the scope of work and responsibilities are clearly defined.

This is remote research project management during a pandemic where almost all research collaboration activities are remote and online. However, a small percentage (10%) of the research collaboration project managers in this study learned a new set of skills or technology to help them address the challenges associated with remote research project management. An interview with one of the project managers revealed that his online presence has increased. He has learned to use various tech platforms for messaging and audio/video communication with project partners. His online interaction with project members provided him with visibility, leading to improvement in collaboration to achieve greater productivity in the project. In terms of the technical research infrastructure and home environment, there were significant differences between the Global North and South.

Thus, the authors posit that this research can potentially add to an understanding of the nature of research collaboration and how to manage research collaboration projects involving partners from the Global North and South. The empirical study can also act as a best-practice guideline or lessons learned dossier for project management professionals, Clusters of Excellence, and universities interested in pursuing or sustaining research collaboration during a pandemic. For many researchers and project managers, the online or hybrid meeting formats will most likely continue. They provide chances for flexible research collaboration project management, and no face-to-face cooperation without the need to travel for short distances.

Future Work

The authors are planning to use the analysis framework (Figure 2) and a modified version of the current survey to investigate post-pandemic North-South research collaboration projects. This will provide more insight into the tools and techniques researchers and project managers used to cope with the pandemic. Besides, as discussed in the research methodology (Figure 1), the authors are also planning to conduct more semi-structured interviews with 10% of the survey respondents who classified themselves as principal investigators/project managers.

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CONFLICT OF INTEREST

The authors of this publication declare there is no conflict of interest.

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