# What Remotely Matters? Understanding Individual, Team, and Organizational Factors in Remote Work at Scale

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Although knowledge workers are increasingly able to adopt remote and hybrid working arrangements and work productively, many organizations continue to question the effectiveness of remote work and focus on its concerns and challenges. Previous CSCW research shows that remote workers have limited awareness of other workers, require more explicit coordination, and feel excluded from in-person colleagues. Research also shows that adopting work practices and technologies that are remote work-friendly can offset many of these challenges. Identifying which effective practices and challenges are most helpful or hurtful to remote workers—and how workplace attributes (e.g., team structure; communication frequency; tool use) affect them—could strengthen organizations' strategies and policies for remote work. Through a theoretically-informed survey of 1,526 U.S. knowledge workers, we find many factors prior research has argued as essential to remote work, such as knowing your teammates personally, to be the least important for remote workers, and show how workplace attributes influence those perceptions. We provide theoretical and practical implications for future research for organizations that wish to support remote and hybrid work modalities.

CCS Concepts: • **Human-centered computing** → **Empirical studies in HCI**.

Additional Key Words and Phrases: distributed teams; virtual teams; remote work; hybrid work; knowledge work; knowledge workers; work enablers; work barriers; survey methods

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*Research conducted during an internship with Slack's Workforce Lab.

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# 1 Introduction

The rapid surge of remote knowledge work has sparked widespread discussions about its benefits and challenges.[1] While only 7% of U.S. knowledge workers were in remote environments in 2019, approximately 35% were remote by February 2023 [89]. Driven by the COVID-19 pandemic, organizations invested heavily in developing remote work infrastructures and practices, enabling their workers to continue performing their jobs and services out of the office [12, 110]. For the first time, workers and managers question whether large-scale remote work is viable long-term [11, 111].

Despite growing adoption, organizations and managers continue to question the effectiveness of remote work. Some managers argue that remote work increases coordination challenges and reduces impromptu knowledge-sharing interactions essential for complex work [12]. As the healthcare crisis caused by COVID-19 passed, many organizations advocated for returning to the office and reducing hybrid or remote work, facing opposition from many workers [56]. Significant CSCW research demonstrates that remote workers are often invisible to their colleagues and struggle to collaborate when geographically and culturally apart [84, 86]. While workers can overcome these obstacles, they must spend significant effort coordinating work and maintaining common ground compared to collocated workers [20, 54]. Nevertheless, recent research indicates that physical and temporal distance matters less for remote work than previously thought, with *workplace attributes*—workplace technologies, organizational infrastructures, and collaboration practices—playing a larger role in effective remote work [117]. Researchers also identified strategies for coordinating remote tasks and rule-setting for collaborations to reduce the impact of these factors [118]. Further, evidence suggests that workers are productive when away from the office, rebuking the idea that knowledge work can only happen effectively in-person [111].

As organizations and workers debate the benefits and drawbacks of remote work, understanding what attributes make remote work effective in post-COVID-19 pandemic workplaces is critical. Identifying the most relevant practices and challenges for remote work and how workplace attributes are associated could strengthen organizations' remote work strategies, guidelines, and policies. While prior qualitative research provides a better understanding of helpful work practices and common challenges [20, 84], large-scale examination of these factors and their relative importance remains limited. Further, prior studies have primarily focused on research or software teams [50, 60, 101] whose tasks [80] and collaboration norms differ substantially from other professions (e.g., finance- or legal-related roles). Knowledge workers engage in many tasks that make up their roles [93], and it is unclear if different tasks benefit from or are hindered by different practices. Quantitatively studying these factors will help us understand how different workplace configurations enable or create barriers to remote work. As professionals continue moving away from traditional offices in favor of increasingly remote work modalities [88], assessing the impact of work activities and workplace attributes on the factors that enable or present a barrier to effective remote work will be an important step for the future of distributed work.

In this paper, we examine the factors that knowledge workers perceive as enablers and barriers of remote work and how these factors correlate with different work activities or workplace attributes. We perform this analysis by designing a survey grounded in a theoretical understanding of individual, team, and organizational factors that enable or create barriers to remote work. After piloting this survey, we conducted a main survey collection, obtaining 1,526 responses from U.S.-based knowledge workers recruited from a Qualtrics panel. All workers were either hybrid or fully remote,

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[1]We use "remote" to refer to remote and hybrid work arrangements where at least some of the knowledge worker's time is spent away from their company or client's office (in contrast to in-person work only at the office). We also refer to "knowledge workers" as workers for simplicity.

and worked in various industries, roles (e.g., manager versus individual contributor), and levels of seniority. Through our statistical analysis, we sought to answer the following research questions:

**RQ1:** What factors do knowledge workers perceive as enablers and barriers of remote or hybrid work activities?

**RQ2:** What individual, team, and organizational-level differences affect workers' perceptions of the enablers and barriers of remote work?

Our findings show that the main enablers for remote and hybrid work include: *Having the tools I need*, *Willing to share helpful information with each other*, and *Knowing who to ask for help if a problem comes up*. In contrast, the main barriers were *Lacking resources to resolve problems that come up*, *Not having permission to access a shared document*, and *Being micromanaged in how I do the work activity.* Surprisingly, many respondents reported that they did not find value in enabling factors that prior research found essential for remote work (e.g., *Having met teammates in person*), suggesting a potential shift from prior beliefs and best practices. Moreover, logistical challenges often raised as issues with remote work (e.g., *Being unable to whiteboard or sketch out ideas together in real time*; *Not knowing my team on a personal level*) were not perceived as significant hindrances. We also show how different workplace attributes influence participants' perceptions. For instance, hybrid teams—where some team members are virtual and some in-person—reported the barriers to remote work we asked about (e.g., lacking a sense of belonging; distractions in the workplace) to be a greater hindrance to their work than teams with only remote members. We contextualize these findings in recent research on supporting remote workplaces, provide practical implications, and suggest future research on understanding what makes remote work effective.

Our paper makes the following three contributions to CSCW:

(1) We quantitatively examined and tested existing theories on socio-technical enabler and barrier factors and how different workplace attributes affect knowledge workers' perceptions of these factors. We show which factors from prior research are broadly relevant across work activities and workplace arrangements, and which are now less relevant.

(2) We piloted and validated an 82-item survey to assess participants' perceptions of remote work's enablers and barriers. Organizations and researchers can employ this instrument on a large scale to understand remote and hybrid work practices.

(3) We provide theoretical and practical implications for researchers, workers, and managers on examining and leveraging remote work practices.

Together, these contributions provide researchers and practitioners with empirical evidence of what is helping and hurting remote work practices, broadly, and how new practices and technologies may help to alleviate issues that workers find critical today.

## 2  Background

We position our research within the existing literature on knowledge workers, remote and hybrid work modalities, and documented challenges associated with distributed work environments.

### 2.1  Knowledge Workers

Knowledge workers engage in non-routine creative problem-solving [40]. While non-knowledge workers primarily focus on manual labor or routine work (e.g., on a manufacturing line; computer data entry), knowledge workers use their expertise, critical thinking, and interpersonal skills to create value [41]. Knowledge work includes executives making business decisions, engineers and designers developing products, and researchers presenting papers. Knowledge workers typically perform many diverse tasks within their professions (e.g., software engineer [80]), such as acquiring and analyzing information, networking with people, and finding experts and resources for

problems [93]. Finally, knowledge work often involves collaboration between multiple workers, creating interdependencies between team members to complete tasks [105]. In 2023, over 100 million knowledge workers resided in the U.S. and between 644 and 997 million worldwide [15]. Given the prevalence of knowledge work, understanding how organizations can help knowledge workers be effective is critically important, especially as remote work modalities become increasingly prevalent.

## 2.2 Remote and Hybrid Knowledge Work

Remote work enables employees to work from various locations outside of a company or client's office, including their homes or other locations. While advances in information and communication technology (ICT) have allowed for global collaboration for many decades (e.g., global software engineering [60]; research collaborations and shared infrastructure [46, 47]), the global COVID-19 pandemic significantly altered organization's capabilities for supporting remote work and workers' perceptions of who can effectively work from home. First, the sudden shift toward remote work necessitated the development of infrastructures and effective ways of working for remote and hybrid work across industries at an unprecedented scale, including those who previously had little support for remote work [12]. Second, the prolonged remote work period demonstrated to organizations that knowledge workers beyond traditionally remote-friendly professions (e.g., software engineers; researchers) could be productive outside of traditional office environments.

Innovations in how we work brought on by the pandemic enable a variety of possible team configurations, where teams are remote-first, hybrid, and sometimes both (e.g., more in-person at the start of a project). This shift had a widespread impact on the virtualness of today's workplaces. Dingel and Neiman estimated that 37% of all U.S. jobs were remote-work compatible [39].[2] Recent data shows that approximately 35% of U.S. workers with remote-compatible jobs worked fully remotely, while another 41% worked hybrid [89]. Globally, 33.5% of workers reported hybrid or fully remote work arrangements, with 81.4% wanting to work from home at least one day a week and 25.7% wanting to be fully remote [4].

Despite remote work's prevalence, individuals' perceptions of its effectiveness differ. Microsoft Research's 2021 study showed that their employees' self-reported productivity remained unchanged after switching from in-person to remote work, on average [111]. Barrero et al.'s survey of U.S.-based remote workers showed that workers were positively surprised by their effectiveness when working remotely [11]. Beyond productivity, organizations also benefit from cost savings by reducing office expenses and labor costs by hiring outside of major metropolitan areas [23]. However, remote work also presents challenges. At the individual level, the boundary between work and personal lives becomes blurred. While remote workers appreciate the flexibility to manage personal matters during the day [79], many reported working longer hours [8, 54, 111]. Remote workers can also feel excluded from their in-office colleagues [24] or decision-making processes [62]. At the team level, managers face increased coordination challenges when managing remote employees [54]. Virtual teams generally require more coordination effort for tightly coupled work (i.e., when people are highly dependent on each other to complete tasks) [20] and are more likely to have inter-group conflict than co-located teams [63, 64]. Lastly, at the organizational level, remote work may increase team siloing, potentially reducing the flow of novel information between teams [121].

As remote work adoption accelerates and organizations adopt emerging technologies to support distributed teams, the CSCW community must examine remote workers' perceptions of what factors are *enablers* or *barriers* to their work productivity and satisfaction. Understanding these

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[2]Remote-compatible jobs do not require specialized equipment or people that are only available in-person [39]. For instance, software engineers and many computer science researchers can access servers remotely, but chemistry and biology researchers may require on-site lab equipment. Similarly, doctors and nurses must work in a hospital or clinic setting.

perceptions and the design space of potential workplace configurations amenable to remote and hybrid work will be critical as organizations become increasingly distributed.

## 2.3 Empirically-Known Challenges With Remote Work

Significant research has studied the *socio-technical factors*-including individual, team, and organizational practices—that make remote work challenging. In 2000, Olson and Olson established the "Distance Matter" framework that argued distributed work is challenging for five reasons: remote teams (1) struggle with establishing the common ground necessary for effective communication, (2) have tasks that are coupled or dependent on multiple workers, (3) lack incentive structures or norms for adopting new collaboration processes, (4) possess limited technological competency, and (5) are part of ambiguous reporting structures at the organizational level [84, 87]. The Distance Matters framework remains relevant despite two decades of evolving workplace norms and technological advancements. Recent research confirms that common ground, collaboration readiness, and organizational and managerial factors continue to present significant challenges for remote workers [20]. Hu et al. extended this framework to include inter-team collaboration challenges, noting that work practices optimized for internal team collaboration can harm collaboration across teams [67]. Moreover, as hybrid work arrangements become prevalent, Duckert et al. showed that hybrid teams struggle with *collocated distance*, where building common grounding and balancing sub-group dynamics is harder than in entirely in-person teams or fully remote teams [43].

Prior research has also provided best practices for remote teams to address these challenges. At the individual level, Olson and Olson recommend that team members establish common ground and collaboration readiness factors by discussing shared vocabularies and work styles with collaborators [86]. At the team level, workers can minimize their interdependence in tasks [61] and encourage frequent, spontaneous communication to develop stronger shared identities [64]. At the organizational level, workers benefit from informal hierarchies that they can communicate across without going through a manager, and having knowledge management systems or liaisons that make cross-site information more visible [61]. While prior work has identified the factors that hinder remote work and best practices to overcome these barriers, we know little about which factors matter to workers today and how different configurations of workplaces affect these perceptions. For instance, many knowledge workers who entered the workforce during the COVID-19 pandemic never met their team in person but remained successful despite that, contradicting earlier research that suggested in-person interactions were critical for remote work success [84]. Re-evaluating these factors and their importance will be crucial for supporting modern remote work.

Despite significant research in CSCW on remote work effectiveness, most studies were conducted prior to [20, 60, 84] or in the early stages of the pandemic [1, 50, 52, 98, 99, 101]. In contrast, the proportion of U.S. full-time remote or hybrid workers did not stabilize until late 2022 [53]. The timings of these studies are critically important since work practices and cultural norms evolved substantially as managers learned how to support remote teams and teams discovered what practices were effective for them [45]. Transitions to remote work were successful because the wide-scale adoption allowed workplaces to experiment with and refine their workplace norms and infrastructure (e.g., meeting structures; tools) to be effective for the changed work modality [12]. Barrero et al. showed that most workers and managers were initially pessimistic about the efficacy of remote work, but later found that remote work experiences were better than average and were productive [11]. Consequently, the dramatic changes in how distributed teams work necessitate a reassessment of the factors that workers find helpful and hurtful to remote work in post-pandemic workplaces, and an examination of *workplace attributes*—team size, communication frequency, meeting modality, etc.—that influence those perceptions.

## 2.4   What is Relevant Today for Remote Work?

While we know the factors that may influence remote work success, such as how well common ground is established, we must understand the relative importance of these factors so that workplaces can prioritize design decisions to maximize worker effectiveness. Previous studies have primarily used qualitative methods that allow us to understand why the challenges for remote work exist (e.g., [20, 84]). However, these approaches do not quantify what factors workers consider essential across different professions and work contexts (e.g., small versus large teams). Furthermore, existing research does not study how different knowledge work activities that involve different types of collaboration and communication [93] may require different work environments even for the same profession (e.g., software planning versus software development).

We address these challenges through survey methods theoretically informed by prior research on distributed work. While prior research has conducted large-scale surveys to understand the prevalence of remote work [4, 12], their primary focus has been on understanding the *socio-economic* factors enabling productive remote work (e.g., homes with office space [26]; working in the information sector [12]). Other studies have investigated the effects of remote work on workers' well-being [30, 101], including the positive outcomes (e.g., less commute time) and negative consequences (e.g., lack of routine) [50]. In contrast, our work explores the *socio-technical* factors that make remote workers successful, including individual work practices, team culture, and organizational support. Additionally, we identify the *workplace attributes* that workers feel help and hurt their ability to do remote work, which includes work processes, collaboration structures, and productivity tools remote or hybrid teams use. By understanding these workplace attributes and how they affect workers' perceptions, we can inform the design of work environments suitable for different knowledge work activities and caution organizations on potential issues with existing workplaces that may negatively impact remote workers. Closer to our goal, prior studies analyzed log data in organizations to show who bears the burden of shifting work schedules when working across time zones [82], increases in coordination work [54], and the siloing of collaboration networks in an organization [121]. Building on these findings, our work examines what factors knowledge workers perceive as enablers or barriers to their remote or hybrid work and what workplace attributes at the individual, team, and organizational levels affect them. We ask:

**RQ1:** What factors do knowledge workers perceive as enablers and barriers of remote or hybrid work activities?

**RQ2:** What individual, team, and organizational-level differences affect workers' perceptions of the enablers and barriers of remote work?

Many larger-scale studies of remote work have focused on software engineers [50, 60, 101] rather than the broader population of knowledge workers. While software engineering is a form of knowledge work, it represents a specialized subset of work activities compared to the diverse range of knowledge work people engage in (see [93]). Software engineers spend most of their day in meetings, planning software, writing code, fixing bugs, or learning [80]. In contrast, product managers working with software engineers conduct user research and testing, work with design and business teams, and track progress to coordinate support when necessary [113]. Different professions, such as legal work and finance, may look completely different in their daily activities. For example, lawyers must coordinate with their team, opposing legal counsel, and multiple clients as they prepare materials for cases.

Moreover, the technologies and work processes that enable distributed work differ greatly across professions. Software engineers have historically been well-positioned for distributed work, given the rich ecosystem of version control tools, resource management, and collaborative coding

platforms [10, 50], as well as the collaboration practices necessary to develop code collaboratively [19, 69]. However, knowledge workers in other professions have only recently gained access to profession-specific online technologies that allow them to work remotely, such as cloud-based CAD software for engineers (e.g., Autodesk's Fusion 360 or Onshape). A 2023 International Monetary Fund study showed that non-ICT sectors experienced substantial increases in digitization through increased adoption of computer use and internet technologies during the COVID-19 pandemic [68]. Integrating these technologies into one's workflow can take time, especially when unfamiliar [16]. A historical lack of access and familiarity with such tools may have influenced how they understood the cloud software, video-conferencing, and online communication tools that made remote and hybrid work possible [12].

Finally, software engineering could reap the benefits of remote work at the start of the COVID-19 pandemic since distributed software engineering had been well-studied for nearly two decades before the pandemic. Consistent with Rogers's Diffusion of Innovation model, early adopters—professionals familiar with distributed work practices and technologies, such as software engineers—adapted more quickly than the broader workforce [95]. Understanding both perspectives is valuable for comprehending how work practices and technology evolve to support computer-supported cooperative work. Our research addresses this gap by conducting our study following the stabilization of remote work practices and recruiting a diverse panel of U.S. knowledge workers across industries and roles. This allows us to analyze how different work activities relate to enablers and barrier factors for remote work.

## 3 Method

We developed and conducted a survey to gather empirical data on what workers perceive as enablers or barrier factors for their remote work activities. Moreover, this survey aims to examine the impact of workplace attributes (e.g., team size, communication frequency) on workers' perceptions of their productivity and satisfaction with remote work. Survey methods allow us to assess what individuals perceive as enablers and barriers, as well as their relative importance. In this section, we describe the survey instrument and its development, the study participants and data collection process, and our analysis methods.

### 3.1 Survey Instrument

*3.1.1 Enabler and Barrier Scales for Remote Work.* We first developed theoretically informed scales to assess remote work's enablers and barriers by reviewing prior literature on remote work. For enablers, we referred to the "Distance Matters" framework, which includes a series of constructs important for successful distributed collaboration [84, 87], and drew on related literature to develop our questionnaire. These include circumstances that lead to developing and maintaining common ground [31, 94, 107]; collaboration readiness [5, 21, 34, 51, 74, 97, 120]; technical readiness [21]; how coupled the work is, namely if being independent in work is helpful [42]; and organization and management support [61, 115]. See Table 2 for enabler scales and their items.

For barriers, we included constructs identified by previous research as challenging for remote collaborative work. These include worker's sense of belonging [55]; distractions during work [36, 52, 79]; lacking access to support [2]; agency in how one works [52, 119]; lack of visibility of teammates availability and work progress [104]; and coordination challenges when collaborating with teammates within teams [72, 77, 116] and across teams [67]. The research team selected these constructs based on reviewing prior work that studies challenges for remote work, and soliciting feedback from remote knowledge workers in an industry research team. See Table 3 for barrier scales and their items.

We designed these scale items using a 5-point Likert scale for all enabler constructs (1: Not at all helpful; 5: Extremely helpful) and barrier constructs (1: Not a barrier; 5: Extreme barrier), along with a "0: Not applicable to me" option.

*3.1.2 Work Activities, Workplace Attributes, and Demographics.* To assess the impact of common work activities on enabler and barrier constructs for remote work, we included a set of activities to select from based on prior theory in the survey. Many taxonomies and frameworks have been studied to define the process of knowledge work in the workplace (e.g., transitions between team activities [76]) and the level of interdependence between group members when doing work activities [108, 112]. Closer to this goal is McGrath's circumplex model of group tasks [78] that considers different kinds of tasks people do (e.g., generation, selection, negotiation, or execution tasks), and Reinhardt et al.'s taxonomy that focuses on discrete, linked work activities in the workplace that comprise knowledge work [93]. Therefore, we drew on the latter to develop our survey as it provides specific kinds of knowledge work activities that workers frequently engage in. The survey required participants to select their most common activity.

We included other questions in the survey to control for the workplace attributes of the respondents; see Table 1. The survey included questions about the team structure (whether workers interact intra-team, inter-team, or with teams external to their home company), size, and familiarity with each other. The survey also asked how often team members communicate with each other for the work activity, what tools they use, and how and where they meet. These workplace attributes were developed by the research team—whose members have backgrounds in CSCW, organizational and management science, and network science—and through consultation with an industry research team, whose members study the future of work.

Finally, the survey included questions about participants' general demographic information, including their age, gender, work experience, and time spent in their current role.

*3.1.3 Piloting the Survey.* To develop our survey, we conducted multiple rounds of cognitive testing and small field deployments [92]. We conducted initial cognitive tests during survey development with the research team and knowledge workers associated with the research team. Once we had a complete survey instrument, we conducted an unmoderated cognitive test with five knowledge workers recruited on UserTesting[3], where testers completed the survey while talking aloud without a researcher present. We instructed testers to discuss any difficulties or confusion while completing the survey. Following cognitive tests, we conducted a 50-person pilot study, adding an open-response question for respondents to share any confusion.

We made small wording changes to question prompts from the latter two rounds of testing. We also learned that asking participants to speak about multiple activities caused survey fatigue. As a result, our final survey only asks for the most common work activity participants do; we discuss this trade-off in the limitations section. All survey items can be found in Appendix A. Our final survey took approximately 10 minutes to complete. Responses from the UserTesting testers *were not* included in the final sample; responses from the 50-person pilot *were* included.

## 3.2 Main Survey

*3.2.1 Recruitment and Participants.* We contracted a panel of U.S.-based knowledge workers from Qualtrics[4], a survey research firm. The panel consisted of knowledge workers across industries, roles, and demographics; our sample of this panel consisted of approximately 1,500 respondents, as detailed later in this section. Our survey was hosted on the Qualtrics platform from August 2023

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[3]https://www.usertesting.com/
[4]https://www.qualtrics.com/

Table 1. Workplace attributes and demographic information used in mixed-effect models for RQ2.

| Workplace Attribute | Survey Question |
| --- | --- |
| Team Structure | When you do [work activity], who else is involved? Select all that apply. |
| Team Size | When you work on [work activity], about how many people do you work with in total? |
| Team Tenure | How long have you worked with your team for [work activity]? |
| Team Communication Frequency | When working on [work activity], how often do you communicate with your team? |
| Team Work Hours | For [work activity], which of the following best describes when your team is expected to work? |
| Work Activity Location | When working on [work activity], where does your team typically work? |
| Team Meeting Modality | When working on [work activity], which of the following best describes how you use video conferencing software, like Zoom, when meeting with collaborators? |
| Work Activity Sync-ness | When working on [work activity], how do you collaborate with your team? |
| Comm tool use: email | How frequently do you use Email-related tools when doing [work activity]? |
| Comm tool use: messaging | How frequently do you use Messaging-related tools when doing [work activity]? |
| Comm tool use: audio or video call | How frequently do you use Audio- or Video-call related tools when doing [work activity]? |
| Job Role | What is your current or most recent role? |
| Time working professionally | About how many years have you worked professionally? For increments less than a year, please use decimals (e.g., 0.25; 0.50). |
| Time in current role | About how many years have you worked at your current role? For increments less than a year, please use decimals (e.g., 0.25; 0.50). |
| Age | What is your age? |
| Gender | What is your gender? |

to October 2023, allowing participants to complete the survey with a computer or mobile device. The first portion of the survey screened participants based on industry and job role—selecting workers whose work requires non-routine creative problem solving [41]—and work arrangement— selecting only full-time, fully remote, or hybrid workers; see Appendix A.2. Survey participants were compensated between $3.60 and $6 USD for their survey completion by Qualtrics, dependent on their choice of payment (e.g., Amazon Gift Card, digital currencies); the research organization conducting the study also provided funding.

*3.2.2 Ethical approval.* We conducted two rounds of ethics review before piloting and launching the survey. First, an internal board reviewed the experimental design and privacy protection practices. Once the survey was approved internally, a Qualtrics staff member reviewed it for ethical considerations before deployment. Members of the Qualtrics panel we solicited completed any necessary paperwork consenting to anonymized data collection as they were onboarded to the panel; they then opted in again when taking our specific survey. Upon completing the survey, Qualtrics de-identified users' responses before providing the data to researchers. The research team conducted our data analysis on de-identified data only.

*3.2.3 Data quality.* We took the following steps to ensure data quality. First, we added attention checks throughout the survey, and only respondents who passed all checks were included in the

sample. Second, responses completed in under five minutes (under 50% of the median completion time of 10 minutes) were removed for speeding through the survey. Finally, researchers manually examined the open-text responses collected to check for data quality issues, such as a respondent not being a knowledge worker based on job title.

*3.2.4 Quota and sample representation.* Since respondents' work activities were a primary variable of interest, we quota-sampled on that question. We set initial quotas for each activity at 115 (13 work activities × 115 responses ≈ 1,500 total sample size), allowing responses to come in naturally until all quotas were filled. As we approached the end of data collection, we encountered difficulties in meeting the target quota for two work activities (i.e., "Writing documents, articles, and/or presentations" and "Building team cohesion"). To address this issue, we adjusted the quota criteria to allow responses for any work activity for the remaining sample to ensure the study's completion.

Overall, we had an average of 114 responses per work activity ($SD = 9.51$), with a minimum of 98 responses and a maximum of 129 responses. While we did not quota on gender and age, our final sample was similar to the U.S. population; see Appendix B. Since we recruited knowledge workers only, the education levels of our sample were skewed toward respondents with a college degree or more. Our final dataset consists of 1,526 responses. Summary statistics for the sample are available in Appendix C.

## 3.3 Analysis Methods

To understand what knowledge workers find as enablers and barriers of remote work (RQ1), we examined the individual items of the survey to see which are most helpful or hurtful for remote work practices. For each item, we computed the sample mean rating and 95% confidence intervals for the population mean using bootstrapping with 10,000 samples. We also visualized the responses as a diverging bar plot to analyze the level of low-level agreement (i.e., 1 or 2 rating) and high-level agreement (i.e., 4 or 5 rating) for each enabler and barrier item. Before computing means and confidence intervals, "0: Not applicable to me" responses were removed.

To examine the effect of workplace attributes on the enabler and barrier scales (RQ2), we created mixed-effect regression models using the survey data. We performed the following steps to ensure the normality assumptions of our regression models:

- We included all independent and control variables described in Section 3.1.1, except for "Responsibilities at Work and Industry" due to multicollinearity; "Productivity Tools" since the variety of tool use would make it difficult to see how they correlate with our scales; and "Remote Comfort" since it does not tell us about how the workplace contributes to a worker's perceived helpfulness or hindrance of our scale.
- We created a higher-level "Communication Tool" variables for Messaging (combining Slack, Microsoft Teams, and Other Messaging / Video), Email (Gmail, Microsoft Outlook, Other Email), and Audio / Video calling (Zoom, Cisco Webex, Google Meet, Phone calls) by taking the max value of usage frequency from the tools in each category. Our survey asks respondents to specify how frequently each tool (e.g., Slack, Teams, Gmail, etc.) is used to give them granularity in selecting the different tools they use. For analysis, however, we wanted higher-level categories representing communication interaction (e.g., messaging versus calls) when working.[5]
- We converted the ordinal variables (i.e., Team Size, Team Communication Frequency, and each aggregated Communication Tool variable) into continuous variables.

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[5]We recognize that some tools have multiple purposes, such as Slack or Teams for video calling. However, we focus on the primary use case of these tools in the workplace, such as a messaging platform, and construct the categories around them.

- We filtered out data for categorical variables with < 30 responses ($\approx$ 2% of the final sample). These included *Non-binary* or *Prefer not to say* for Gender[6]; *Other* for Team Work Hours; *Not Applicable* for Team Meeting Modality; and *Other* for Activity Team Structure.
- We normalized all numerical coefficients before running the models.

For the dependent variables, we constructed pooled variables of all items in each enabler and barrier scale (found in Appendix A.5). Each scale was a simple average of all enabler and barrier items associated with it. If a respondent reported '0: Not applicable to me" for any item within a scale, we excluded their data for only that scale. While this leads to different sample sizes for each model (as shown in Table 4 and Table 5), it preserves more data for the analysis than if we removed the respondent from all scales instead.

For the barrier scale "Coordination Challenges", we created two scales for our regression analysis since only part of our sample received the two questions about the challenges of working with a non-primary team. The first scale, "Coordination Challenges (All Items)", includes all items in the original Coordination Challenges scale. Since the last two items were presented only to respondents who work with a non-primary team, this scale effectively excluded the data of those who only work with their primary team once filtering is applied (approximately 37% of our sample). The second scale, "Coordination Challenges (Items Removed)", drops the last two items to address this. This allows us to see how the coordination challenges affect our sample, including those who only work with their primary team. We tested the reliability of all scales by computing Cronbach's Alpha. All enabler and barrier scales had a good agreement (>= 0.60), except for "Common Ground" (0.47) and "Coupling of Work" (0.41). We present these in the following analysis and note their limitations in the discussion.

Prior to modeling our data, we ran a Kruskal-Wallis Analysis of Variance test between work activities and the enabler and barrier ratings that would allow us to see if there were any significant differences in respondents' ratings of the enabler and barrier scales across work activities. To correct for multiple comparisons, we applied corrections to the $p$-values using the Benjamini-Hochberg procedure [14]. For the enabler scales, we found that responses for "Collaboration Readiness" ($p < 0.05$), "Technical Readiness" ($p < 0.05$), and "Coupling of Work" ($p < 0.05$) were significantly different per work activity. For barrier scales, we found "Lacking Sense of Belonging" ($p < 0.001$) and "Coordination Challenges" (Items Removed) ($p < 0.01$) to be significantly different.

Lastly, we modeled our data using a mixed-effects linear regression model, which allows us to understand the impact of each workplace attribute on enabler and barrier scales while accounting for potential differences due to work activity [28]. Since our analysis of variance tests revealed some differences for work activities across enabler and barrier scales, we modeled them as a random effect to separate the variance they explain from other variables. We modeled all other independent variables as fixed effects. We created a separate model for each enabler and barrier scale. As previously mentioned, we verified that our models met the assumptions of linear regression, including the linear relationship between variables, independence between responses, homoscedasticity of residuals, normality of errors and random effects, and no multicollinearity (all variance inflation factor (VIF) scores were under 5). We conducted all these analyses using *R* (v 4.3.2)[7].

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[6]We initially included all gender responses in our analysis and found that only "Coordination Challenges" (All Items) had a significant effect for non-binary respondents compared to male respondents ($\beta = -1.332$, Std. Error = 0.660, $p < 0.05$), but with only two observations. Because of the small sample size and lack of confidence in this finding, we do not include it in the final model.

[7]https://www.r-project.org

## 4 Results

Our analysis of 1,526 survey responses revealed six high-level themes about knowledge workers' perceptions of remote work enablers and barriers. This section presents our findings organized by our research questions. The subsequent Discussion section examines broader themes from these findings and discusses their practical implications for knowledge workers and workplaces.

### 4.1 RQ1: What factors do knowledge workers perceive as helping or hindering their remote or hybrid work activities?

We first analyze the individual items of the enabler and barrier scales to assess knowledge workers' perceptions of how helpful or hurtful they are more broadly than prior ethnographic studies. For brevity, we discuss the most salient results; the rest are present in the referenced tables and figures.

Table 2. 95% confidence intervals for enablers, sorted by mean agreement of how much the enabler is a helpful factor (1: Not at all helpful; 5: Extremely helpful). "0: Not applicable to me" responses are excluded.

| Enabler Scale | Item | Num. Obs. | Mean | Std. Dev. | CI Lower | CI Upper |
|---|---|---|---|---|---|---|
| Common Ground | Knowing who to ask for help if a problem comes up | 1,524 | 4.344 | 0.816 | 4.303 | 4.385 |
| | Knowing what others are working on | 1,515 | 3.843 | 1.022 | 3.791 | 3.894 |
| | Having met my teammates in-person before | 1,469 | 3.549 | 1.243 | 3.486 | 3.613 |
| Collaboration Readiness | Willingness to share helpful information with each other | 1,523 | 4.348 | 0.812 | 4.307 | 4.389 |
| | Trusting my teammates' ability to do the work | 1,521 | 4.269 | 0.848 | 4.226 | 4.312 |
| | Sharing the same expectations of work quality | 1,523 | 4.213 | 0.828 | 4.172 | 4.255 |
| | Understanding how my team likes to communicate and work together | 1,521 | 4.211 | 0.826 | 4.169 | 4.253 |
| | Teammates sharing work progress and obstacles | 1,521 | 4.151 | 0.863 | 4.108 | 4.195 |
| | Trusting my teammates' motives | 1,514 | 4.118 | 0.892 | 4.073 | 4.163 |
| | Feeling connected to my teammates | 1,519 | 4.000 | 0.959 | 3.952 | 4.048 |
| Technical Readiness | Having the tools I need | 1,524 | 4.435 | 0.795 | 4.395 | 4.475 |
| | Sharing the same set of tools across my team | 1,519 | 4.117 | 0.925 | 4.071 | 4.164 |
| | Sharing the same norms for using the tools in my team | 1,511 | 3.971 | 0.909 | 3.925 | 4.017 |
| | Being able to change tools when necessary | 1,513 | 3.953 | 0.948 | 3.905 | 4.001 |
| Coupling of Work | Having clear, well-defined steps | 1,525 | 4.316 | 0.828 | 4.274 | 4.358 |
| | Being able to work autonomously | 1,512 | 4.106 | 0.945 | 4.059 | 4.154 |
| Organizational and Management Factors | Managers trust us to get the work activity done | 1,517 | 4.284 | 0.864 | 4.241 | 4.328 |
| | Transparency on why management wants me to do the work activity | 1,514 | 4.089 | 0.922 | 4.043 | 4.136 |
| | Managers help establish communication norms when doing the activity | 1,512 | 4.009 | 0.946 | 3.961 | 4.056 |
| | Knowing the hierarchy of who reports to whom | 1,511 | 3.929 | 0.998 | 3.879 | 3.980 |

*4.1.1 Enabling Factors Are Generally Helpful to Knowledge Workers.* Overall, respondents found all the enabler items to be generally helpful for their work activities (average of 3: Moderately helpful or higher), which indicates that the socio-technical factors suggested by Olson and Olson are broadly still relevant; see Table 2. However, what workers found most and least helpful differed from prior work. On the one hand, the three most enabling factors were *Having the tools I need* (Mean = 4.435, CI = [4.396, 4.476]), *Willingness to share helpful information with each other* (Mean = 4.348, CI = [4.307, 4.389]), and *Knowing who to ask for help if a problem comes up* (Mean = 4.344, CI = [4.303, 4.385]). On the other hand, the three least enabling factors were *Knowing the hierarchy of who reports to whom* (Mean = 3.929, CI = [3.880, 3.979]), *Knowing what others are working on* (Mean = 3.843, CI = [3.791, 3.894]), and *Having met my teammates in-person before* (Mean = 3.549, CI = [3.486, 3.612]). In contrast to prior work, which suggested that personal familiarity with co-workers and their tasks was of greater importance [84], our results suggest that remote workers perceive having the necessary tools and information to do their work to be more helpful.

Respondents noted high levels of agreement (i.e., "Very helpful" or "Extremely helpful") more than half the time across all enabler items, suggesting that these factors are helpful for remote work in

Table 3. 95% confidence intervals for barriers, sorted by mean agreement of how much the barrier is a hindering factor (1: Not barrier; 5: Extreme barrier). "0: Not applicable to me" responses are excluded.

| Barrier Scale | Item | Num. Obs. | Mean | Std. Dev. | CI Lower | CI Upper |
|---|---|---|---|---|---|---|
| Sense of belonging | Feeling like I don't belong on the team | 1,395 | 2.582 | 1.427 | 2.507 | 2.657 |
| | Feeling unsure if I'm contributing to the work activity | 1,451 | 2.512 | 1.286 | 2.446 | 2.578 |
| | Fears of being less effective than my teammates | 1,460 | 2.442 | 1.289 | 2.376 | 2.508 |
| | Feeling isolated from my co-workers | 1,464 | 2.403 | 1.293 | 2.337 | 2.469 |
| | Not knowing my teammates on a personal level | 1,466 | 2.272 | 1.243 | 2.209 | 2.336 |
| Distractions and ability to focus | Having too many meetings for the activity | 1,475 | 2.829 | 1.307 | 2.762 | 2.896 |
| | Difficulty in setting boundaries between work and life | 1,482 | 2.671 | 1.325 | 2.604 | 2.739 |
| | Being interrupted by teammates | 1,492 | 2.585 | 1.263 | 2.521 | 2.649 |
| | Having personal caregiving responsibilities (e.g., childcare) | 1,302 | 2.534 | 1.300 | 2.463 | 2.604 |
| | Lacking a quiet place to work | 1,436 | 2.479 | 1.358 | 2.409 | 2.549 |
| Access to support | Lacking resources to resolve problems that come up | 1,480 | 3.130 | 1.351 | 3.061 | 3.199 |
| | Lacking training on procedures or tools for the work activity | 1,466 | 3.037 | 1.374 | 2.966 | 3.107 |
| | Missing informal check-ins and feedback opportunities | 1,478 | 2.708 | 1.257 | 2.644 | 2.773 |
| Flexibility and agency | Being micromanaged in how I do the activity | 1,429 | 3.062 | 1.444 | 2.987 | 3.137 |
| | Struggling to prioritize the activity against others | 1,471 | 2.697 | 1.241 | 2.633 | 2.760 |
| Lack of visibility and trust | Not knowing what work progress has been made | 1,484 | 2.999 | 1.286 | 2.933 | 3.064 |
| | Not knowing who is available to work on the activity | 1,469 | 2.835 | 1.282 | 2.769 | 2.900 |
| Coordination challenges | Not having permission to access a shared document | 1,452 | 3.065 | 1.397 | 2.994 | 3.137 |
| | Being dependent on my teammates' work to do my work | 1,459 | 2.821 | 1.312 | 2.754 | 2.888 |
| | Lack of a dedicated project manager | 1,422 | 2.795 | 1.392 | 2.722 | 2.867 |
| | Different teams using unfamiliar jargon or technical terms | 919 | 2.790 | 1.314 | 2.705 | 2.875 |
| | Keeping multiple teams aligned on work progress and obstacles | 910 | 2.651 | 1.184 | 2.574 | 2.728 |
| | Being unable to whiteboard or sketch out ideas together in real-time | 1,458 | 2.358 | 1.263 | 2.293 | 2.423 |
| | Having different work hours than my team | 1,445 | 2.338 | 1.240 | 2.274 | 2.402 |

general; see Figure 1. The three items with the greatest percentage of high levels of agreement were the same as the most impactful enablers above, with 87.4%, 86.4%, and 85.9%, respectively. *Having the tools I need* had the highest percentage of "Extremely helpful" responses at 59.2%. The three items with the greatest percentage of low levels of agreement (i.e., "Not at all helpful" or "Slightly helpful") were the same as the least impactful enablers, with 8.9%, 11.1%, and 21.9%, respectively. *Having met my teammates in-person before* was notable for having the most respondents specify "Not at all helpful" at 7.1%, but also for having almost double the amount of weak agreement than the 2nd to least impactful enabler, *Knowing what others are working on*.

*4.1.2 Barrier Factors Do Not Pose Major Hindrances to Knowledge Workers.* Across all barrier items, respondents did not report any significant hindrances to their ability to work; see Table 3. The most impactful barriers were *Lacking resources to resolve problems that come up* (Mean = 3.130, CI = [3.060, 3.199]), *Not having permission to access a shared document* (Mean = 3.065, CI = [2.993, 3.136]), and *Being micromanaged in how I do the activity* (Mean = 3.062, CI = [2.987, 3.136]). The least impactful barriers were *Being unable to whiteboard or sketch out ideas together in real time* (Mean = 2.358, CI = [2.293, 2.425]), *Having different work hours than my team* (Mean = 2.338, CI = [2.275, 2.401]), and *Not knowing my teammates on a personal level* (Mean = 2.272, CI = [2.208, 2.336]). When examined with the least important enabler (*Having met my teammates in-person before*), these responses further suggest that the social aspects of in-person work are less necessary for workers to do remote work.

Compared to the enabler items, we see lower levels of agreement for all barrier items; see Figure 2. The three items with the greatest percentage of high levels of agreement were the same as the most impactful barriers above, with 43.6%, 40.5%, and 39.5%, respectively. *Being micromanaged in how I do the activity* had the highest percentage of "Extreme barrier" responses by respondents, at 21%.
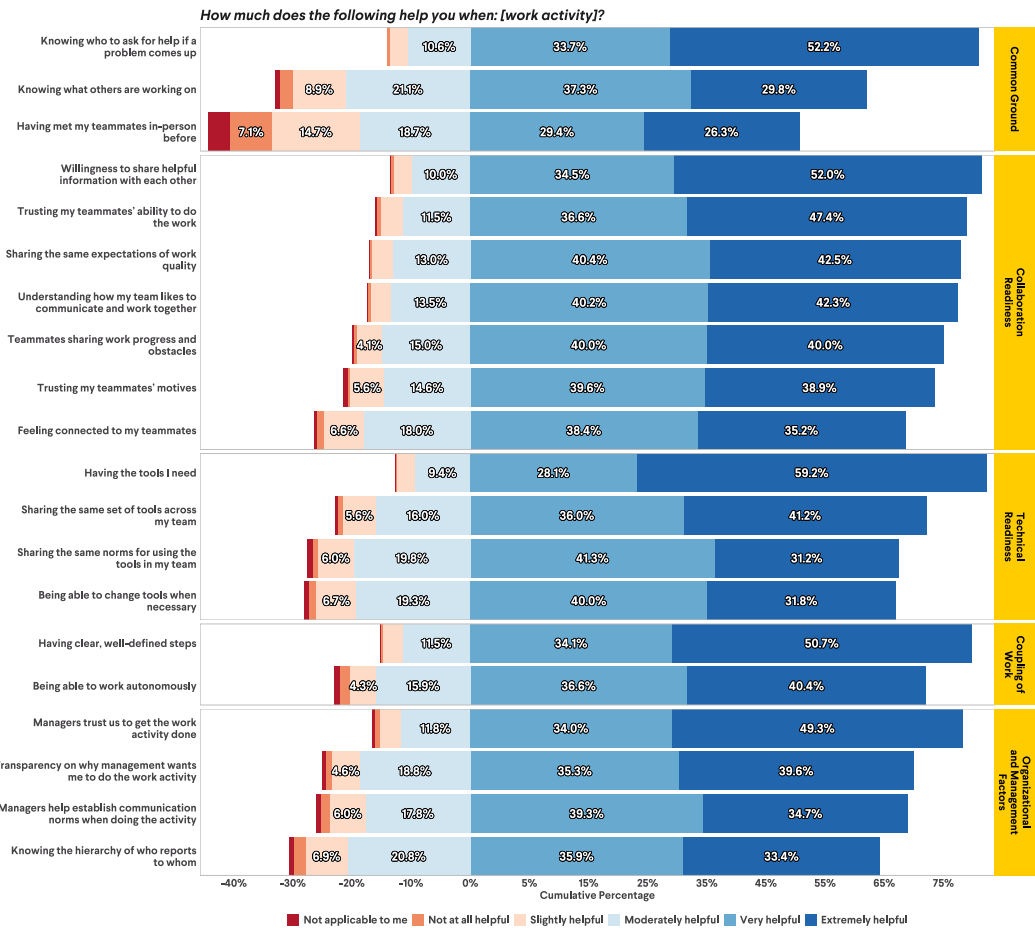
Fig. 1. Diverging bar plot of enabler scale Likert items, sorted by the total amount of high-level agreement (4: Very Helpful or 5: Extremely Helpful). Bar labels under 4% are hidden due to the size of the bars.

The three items with the greatest percentage of low levels of agreement were also the same as the least impactful barriers, with 55.7%, 55.4%, and 59.8%, respectively. *Not knowing my teammates on a personal level* also had the highest percentage of "Not a barrier" responses at 31.7%. We found that *Lacking a quiet place to work* was a notable item since 31.7% of respondents found that as "Not a barrier," in contrast to studies earlier in the COVID-19 pandemic that showed at-home distractions to be a greater barrier [50], suggesting that post-pandemic remote workers have found places in their home or elsewhere with fewer distractions.

## 4.2 RQ2: What individual, team, and organizational-level differences affect workers' perceptions of factors that help or hinder remote work?

To address RQ2, we examined the workplace attributes influencing respondent ratings across enabler and barrier scales. Table 4 and Table 5 report the results of the mixed-effect regression models for each enabler and barrier scale, respectively, described in the following sections.

Fig. 2. Diverging bar plot of barrier scale Likert items, sorted by the total amount of high-level agreement (4: Large barrier or 5: Extreme barrier). Bar labels under 4% are hidden due to the size of the bars.

*4.2.1 Enabler Scales.* We first report on the results of our mixed-effect regression models for the enabler scales; see Table 4. Across all models, we see that the more teams communicate, the more they find each enabling construct helpful for remote work. In contrast, having fewer overlapping hours with the team is associated with enabling constructs being *less* helpful for remote work. The following paragraphs analyze the main findings for each enabler's model.

*Common Ground* refers to a shared base of knowledge that all team members know they have in common. In our study, this construct captures an understanding of each team member's background, areas of expertise, and an awareness of who is working on what. Managers found Common Ground more helped than skilled office workers, with the value increasing as management seniority increased (executive managers: $\beta = 0.363$, $p < 0.001$). Increases in time in the current role ($\beta = 0.077$,

Table 4. Multi-level models for Enabler scales. Only parameters and coefficients for fixed-effect terms that were statistically significant ($p < 0.05$) are shown.

| | Common Ground | Collaboration Readiness | Technical Readiness | Coupling of Work | Org. and Mgmt. Factors |
|---|---|---|---|---|---|
| **Fixed Effects** | $\beta$ (S.E.) | $\beta$ (S.E.) | $\beta$ (S.E.) | $\beta$ (S.E.) | $\beta$ (S.E.) |
| Intercept | 3.813 (0.068) | 4.369 (0.057) | 4.316 (0.060) | 4.442 (0.070) | 4.250 (0.063) |
| Job Role *Reference: Skilled office worker* | | | | | |
| Non-management senior staff | - | -0.113 (0.053) | -0.147 (0.057) | - | -0.140 (0.061) |
| Junior management | - | - | -0.149 (0.056) | -0.158 (0.064) | - |
| Middle management | 0.129 (0.056) | - | - | -0.119 (0.056) | - |
| Senior management | 0.152 (0.072) | - | - | - | - |
| Executive management | 0.363 (0.074) | - | - | - | - |
| Time in current role | 0.077 (0.022) | 0.040 (0.018) | - | 0.048 (0.022) | - |
| Activity team structure *Reference: Primary Team only* | | | | | |
| External Team only | - | - | 0.240 (0.075) | - | - |
| Primary Team and Non-Primary Teams | - | -0.084 (0.043) | - | - | -0.102 (0.049) |
| Team size | - | 0.037 (0.016) | - | - | 0.052 (0.018) |
| Team tenure *Reference: Well-established* | | | | | |
| Somewhat established | - | -0.112 (0.040) | - | -0.172 (0.049) | - |
| New team | - | -0.193 (0.062) | - | - | - |
| Team communication frequency | 0.072 (0.019) | 0.110 (0.016) | 0.118 (0.017) | 0.074 (0.020) | 0.089 (0.018) |
| Team work hours *Reference: Same schedule* | | | | | |
| Standard business hours | - | -0.075 (0.036) | -0.102 (0.038) | - | -0.141 (0.041) |
| Small overlap | -0.260 (0.052) | -0.211 (0.043) | -0.207 (0.045) | -0.158 (0.052) | -0.234 (0.049) |
| Work activity location *Reference: Remotely* | | | | | |
| In-person | 0.160 (0.049) | - | - | - | - |
| Hybrid | 0.334 (0.074) | - | - | - | - |
| Team meeting modality *Reference: All video* | | | | | |
| Most video | - | - | -0.104 (0.040) | - | - |
| Most in-person | - | - | -0.111 (0.047) | - | - |
| Comm tool use: email | - | 0.047 (0.016) | 0.049 (0.016) | - | 0.045 (0.018) |
| **Random Effects** | $\sigma^2$ | $\sigma^2$ | $\sigma^2$ | $\sigma^2$ | $\sigma^2$ |
| Work Activity (Intercept) | 0.000426 | 0.00368 | 0.00236 | 0.00514 | 0.000733 |
| Residual | 0.459132 | 0.31257 | 0.35235 | 0.47067 | 0.406587 |
| **Model Fit** | | | | | |
| Num. Observations | 1419 | 1459 | 1452 | 1463 | 1453 |
| REML | 3038 | 2581 | 2736 | 3173 | 2937 |
| Conditional $R^2$ | 0.1347 | 0.1346 | 0.1244 | 0.0728 | 0.1027 |
| Marginal $R^2$ | 0.1339 | 0.1244 | 0.1185 | 0.0627 | 0.1010 |

$p < 0.001$) and team communication frequency ($\beta = 0.072$, $p < 0.001$) were both associated with Common Ground being more enabling. While there was no significant effect for standard business hours or no expectation of overlapping hours, a small overlap in work hours was negatively associated with Common Ground ($\beta = -0.260$, $p < 0.001$) compared to teams sharing the same work hours. Finally, having any amount of in-person interaction during work activities was positively

associated with valuing Common Ground as an enabler, with hybrid ($\beta = 0.334$, $p < 0.001$) more so than in-person only ($\beta = 0.160$, $p < 0.01$).

*Collaboration Readiness* refers to the organizational culture and norms around collaboration and sharing, and the degree to which team members are supported by the organization to engage in collaborative work. In our study, this construct encompasses a team's trust and willingness to share with each other, a sense of connection, and shared expectations around work quality. Non-management senior staff found Collaboration Readiness factors less enabling for remote work than skilled office workers ($\beta = -0.113$, $p < 0.05$). Increases in time in current role ($\beta = 0.040$, $p < 0.05$), team size ($\beta = 0.037$, $p < 0.05$), team communication frequency ($\beta = 0.110$, $p < 0.001$), and email use ($\beta = 0.047$, $p < 0.01$) were all correlated with Collaboration Readiness as being more enabling for remote work. Somewhat established teams ($\beta = -0.112$, $p < 0.01$) or new teams ($\beta = -0.193$, $p < 0.01$) found Collaboration Readiness less enabling than well-established teams. Similarly, teams that kept standard business hours ($\beta = -0.075$, $p < 0.05$) or only had a small overlap in hours ($\beta = -0.211$, $p < 0.001$) found Collaboration Readiness to be less enabling, compared to the team working the same schedule. Finally, compared to working only with one's primary team, Collaboration Readiness factors were less enabling ($\beta = -0.084$, $p < 0.05$) when working with an additional team in the same organization.

*Technical Readiness* refers to the organization's technical infrastructure, associated work practices, and the team members' preparedness to use the available tools effectively. In our study, this construct captures the availability of collaborative technologies, team members' proficiency with such tools, and their shared norms of use. Non-management senior staff ($\beta = -0.147$, $p < 0.01$) and junior management ($\beta = -0.149$, $p < 0.01$) found Technical Readiness to be less enabling for remote work than skilled office workers found it. As with Collaboration Readiness, teams sharing fewer overlapping hours (standard business hours: $\beta = -0.102$, $p < 0.01$; small overlap: $\beta = -0.207$, $p < 0.001$) found Technical Readiness to be less of an enabler compared to those sharing the same hours. Similarly, teams who mostly met over video ($\beta = -0.104$, $p < 0.01$) or mostly in-person ($\beta = -0.111$, $p < 0.05$) also found Technical Readiness to be less helpful than teams who only met over video call. In contrast, working with an external team positively correlated with Technical Readiness as a helpful factor ($\beta = 0.240$, $p < 0.01$), compared to working only with one's primary team. Increases in team communication frequency ($\beta = 0.118$, $p < 0.001$) and email use ($\beta = 0.050$, $p < 0.01$) were also associated with Technical Readiness being more enabling.

*Coupling of Work* refers to the degree of interdependence that exists between tasks and task components for a work team. In our study, this construct captures the extent to which tasks are well-defined and the extent to which workers can work autonomously. Junior ($\beta = -0.158$, $p < 0.05$) and middle management ($\beta = -0.119$, $p < 0.05$) found less of a need for the Coupling of Work construct than skilled office workers (i.e., they valued well-defined steps and autonomy less). Teams that were *Somewhat established* ($\beta = -0.172$, $p < 0.001$) or only shared a small overlap of collaboration hours ($\beta = -0.158$, $p < 0.01$) also found the Coupling of Work constructs less helpful for remote work. On the other hand, increases in how long a worker was in their current role ($\beta = 0.048$, $p < 0.05$) and how frequently one communicates with their team ($\beta = 0.074$, $p < 0.001$) were associated with Coupling of Work being more enabling.

*Organizational and Managerial Factors* refer to the general organizational context around the work environment. In our study, this construct captures norms around power relationships, trust and transparency, and knowledge of the structural hierarchy of the organization. Non-management senior staff found this construct less helpful for remote work than skilled office workers ($\beta = -0.140$, $p < 0.05$). It was also less helpful when working across multiple teams in the same company

($\beta = -0.102$, $p < 0.05$), compared to only with the primary team. Similar to Collaboration Readiness and Technical Readiness, having less overlap in work hours was associated with Organizational and Managerial Factors being less helpful for remote work, compared to having the same hours (standard business hours: $\beta = -0.141$, $p < 0.001$; small overlap: $\beta = -0.234$, $p < 0.001$). Increases in team size ($\beta = 0.052$, $p < 0.01$), communication frequency ($\beta = 0.089$, $p < 0.001$), and email use ($\beta = 0.045$, $p < 0.05$) were all associated with Organizational and Managerial Factors being more enabling for remote work.

*Impact of Work Activities on Enabling Factors.* Finally, the Conditional $R^2$ is only slightly higher than the Marginal $R^2$, indicating that the differences among work activities explain only a small portion of the overall variance. While we saw multiple enabler scales have significant differences in their distributions due to work activities, these models suggest that much of the variance is explained by including workplace attributes in the model.

*4.2.2 Barrier Scales.* We now report on the results of our mixed-effect regression models for the barrier scales; see Table 5. Across all models, we see that team tenure had a significant effect on each barrier scale, where less established teams found the barrier scales to affect their ability to do work more than well-established teams. Team communication frequency also significantly affected many barrier scales, with more communication suggesting that the barrier scales were more impactful to work. Finally, teams with more hybrid arrangements also found many of the barrier scales to be more hindering to their work than if everyone worked virtually.

*Sense of Belonging* has historically been shown to be an important component of a team member's integration. In our study, this construct captures the extent to which team members feel they are *not* part of the team, not having their work acknowledged by others, and not knowing their teammates in a relational capacity. Executive managers found Sense of Belonging a strong barrier to their work ($\beta = 0.218$, $p < 0.05$) compared to skilled workers. Increases in time working professionally were associated with being *less* of a barrier ($\beta = -0.216$, $p < 0.001$), meaning that issues with belonging fade as work experience increases. Increases in team size ($\beta = 0.087$, $p < 0.01$), communication frequency ($\beta = 0.085$, $p < 0.01$), and audio/video tool use ($\beta = 0.063$, $p < 0.05$) all corresponded to Sense of Belonging being a greater barrier. Somewhat established ($\beta = 0.258$, $p < 0.001$) and new teams ($\beta = 0.416$, $p < 0.001$) were associated with Lacking a Sense of Belonging being a stronger barrier. Similarly, when only most of the team attended by video ($\beta = 0.205$, $p < 0.01$) or in-person ($\beta = 0.273$, $p < 0.001$)—meaning that others were using the opposite modality—Lacking a Sense of Belonging was a greater barrier.

*Distractions and Ability to Focus on Work* primarily captured things that prevented the worker from focusing on their work, including lack of focus time, boundaries between work and life (e.g., childcare responsibilities), and a quiet place to work. Workers reported these distractions as less of a barrier for older workers ($\beta = -0.124$, $p < 0.01$), but a greater barrier as team size increased ($\beta = 0.069$, $p < 0.05$). Somewhat established ($\beta = 0.251$, $p < 0.001$) and new teams ($\beta = 0.357$, $p < 0.001$) found Distractions to be a greater barrier, compared to well-established teams. Teams that worked in a hybrid arrangement ($\beta = 0.245$, $p < 0.05$) or had some attendees in person during meetings (mostly video: $\beta = 0.147$, $p < 0.05$; mostly in-person: $\beta = 0.206$, $p < 0.05$) found Distractions to be a greater barrier.

*Lack of Access to Support* captures the extent to which workers lack explicit mechanisms for feedback and coordination, and the lack of training on processes and procedures from the organization. While somewhat established teams found a Lack of Access to Support to be a greater barrier for remote work than well-established teams ($\beta = 0.172$, $p < 0.05$), the effect was not significant for

Table 5. Multi-level models for Barrier scales. Only parameters and coefficients for fixed-effect terms that were statistically significant ($p < 0.05$) are shown. In all models, Work Activity had a negligible effect on reducing variance as a random effect. As a result, Conditional $R^2$ is not shown for any model.

| | Sense of Belonging | Distractions / Ability to Focus | Access to Support | Flexibility / Agency | Lack of Visibility | Coord. Challenges (All Items) | Coord. Challenges (Items Removed) |
|---|---|---|---|---|---|---|---|
| **Fixed Effects** | $\beta$ (S.E.) | $\beta$ (S.E.) | $\beta$ (S.E.) | $\beta$ (S.E.) | $\beta$ (S.E.) | $\beta$ (S.E.) | $\beta$ (S.E.) |
| Intercept | 2.318 (0.098) | 2.478 (0.103) | 2.976 (0.105) | 2.967 (0.112) | 2.788 (0.110) | 2.572 (0.139) | 2.568 (0.097) |
| Job Role *Reference: Skilled office worker* | | | | | | | |
| Senior management | - | - | - | -0.240 (0.121) | - | - | - |
| Executive management | 0.218 (0.108) | - | - | - | - | - | - |
| Time working professionally | -0.216 (0.050) | - | - | - | - | -0.146 (0.063) | -0.130 (0.048) |
| Age | - | -0.124 (0.047) | - | - | - | - | - |
| Team size | 0.087 (0.028) | 0.069 (0.029) | - | - | - | 0.068 (0.033) | 0.063 (0.028) |
| Team tenure *Reference: Well-established* | | | | | | | |
| Somewhat established | 0.258 (0.070) | 0.251 (0.071) | 0.172 (0.077) | - | 0.171 (0.081) | 0.220 (0.079) | 0.248 (0.068) |
| New team | 0.416 (0.108) | 0.357 (0.108) | - | 0.417 (0.127) | - | 0.341 (0.127) | 0.234 (0.105) |
| Team communication frequency | 0.085 (0.028) | - | 0.110 (0.031) | 0.069 (0.033) | - | 0.090 (0.035) | 0.079 (0.028) |
| Work activity location *Reference: Remotely* | | | | | | | |
| In-person | - | - | -0.158 (0.076) | - | - | - | - |
| Hybrid | - | 0.245 (0.111) | - | - | - | - | - |
| Team meeting modality *Reference: All video* | | | | | | | |
| Most video | 0.205 (0.067) | 0.147 (0.068) | 0.164 (0.073) | - | 0.257 (0.076) | - | 0.141 (0.066) |
| Most in-person | 0.273 (0.079) | 0.206 (0.080) | 0.191 (0.087) | - | 0.276 (0.090) | - | 0.196 (0.078) |
| Work activity syncness *Reference: Same time, communicating* | | | | | | | |
| Same time, no communication | - | - | - | - | -0.189 (0.091) | - | - |
| Comm tool use: email | - | - | - | 0.081 (0.032) | - | - | - |
| Comm tool use: audio / video call | 0.063 (0.028) | - | - | - | - | - | - |
| **Random Effects** | $\sigma^2$ | $\sigma^2$ | $\sigma^2$ | $\sigma^2$ | $\sigma^2$ | $\sigma^2$ | $\sigma^2$ |
| Work Activity (Intercept) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Residual | 0.885 | 0.863 | 1.110 | 1.260 | 1.250 | 0.773 | 0.837 |
| **Model Fit** | | | | | | | |
| Num. Observations | 1280 | 1203 | 1377 | 1360 | 1403 | 780 | 1252 |
| REML | 3566 | 3325 | 4137 | 4253 | 4374 | 2088 | 3421 |
| Conditional $R^2$ | - | - | - | - | - | - | - |
| Marginal $R^2$ | 0.157 | 0.106 | 0.052 | 0.035 | 0.045 | 0.096 | 0.095 |

new teams. Teams that communicate more also found Lack of Access to Support to be a greater barrier ($\beta = 0.110$, $p < 0.001$). Teams that worked on the activity in person found it to be *less* of a barrier than fully remote teams ($\beta = -0.158$, $p < 0.05$). Finally, when teams met in a hybrid capacity (i.e., mostly over video ($\beta = 0.164$, $p < 0.05$) or mostly in-person ($\beta = 0.191$, $p < 0.05$)), Lack of Access to Support was found to be a greater barrier than for teams that only met virtually.

*Lack of Flexibility* focuses on the extent to which one is being micromanaged in their work and limited in how they can prioritize work. Senior managers found this to be less of a barrier than skilled office workers ($\beta = -0.240$, $p < 0.05$). New teams found Lack of Flexibility a bigger barrier than established teams ($\beta = 0.417$, $p < 0.01$). Increases in communication frequency ($\beta = 0.069$, $p < 0.05$) and email use ($\beta = 0.081$, $p < 0.05$) were both correlated with Lack of Flexibility being a larger barrier.

*Lack of Visibility* refers to the extent to which team members struggle to establish an awareness of work progress and co-worker availability. Somewhat established teams found this to be a significant barrier for remote work ($\beta = 0.171$, $p < 0.05$), compared to well-established teams. When teams

met mostly over video ($\beta = 0.257$, $p < 0.001$) or mostly in-person ($\beta = 0.276$, $p < 0.01$), Lack of Visibility was a greater barrier compared to teams where everyone joined meetings virtually. An interesting finding was that when workers were working synchronously without communicating, visibility issues were *less* of a barrier compared to when they were communicating ($\beta = -0.189$, $p < 0.05$). This finding suggests that workers without communication might have been focused on more decoupled tasks that required less awareness of the rest of the team.

*Coordination Challenges (All Items)* was presented to respondents who work with their primary team and another team in the same organization or externally. It measures obstacles related to accessing resources, collaborating with teammates, and working across teams with different work practices or norms. Workers working professionally for longer found these challenges less of a barrier ($\beta = -0.146$, $p < 0.05$). Coordination Challenges were a greater barrier for larger teams ($\beta = 0.068$, $p < 0.05$) and for teams that communicated more frequently ($\beta = 0.090$, $p < 0.05$). Coordination Challenges also posed a greater barrier for less established teams (Somewhat established team: $\beta = 0.220$, $p < 0.01$; New team: $\beta = 0.341$, $p < 0.01$).

*Coordination Challenges (Items Removed)* measures the same obstacles as above, except for when working across teams, since it is presented to respondents who only work with their primary team. Workers working professionally for longer found these challenges less of a barrier ($\beta = -0.130$, $p < 0.01$). Coordination Challenges were a greater barrier for larger teams ($\beta = 0.063$, $p < 0.05$) and for teams that communicated more frequently ($\beta = 0.079$, $p < 0.01$). Less established teams also saw Coordination Challenges as a greater barrier (Somewhat established team: $\beta = 0.248$, $p < 0.001$; New team: $\beta = 0.234$, $p < 0.05$). When there was a disparity in how team members attended a meeting, with most on video call ($\beta = 0.141$, $p < 0.05$) or most in-person ($\beta = 0.196$, $p < 0.05$), Coordination Challenges were a greater barrier.

*Impact of Work Activities on Barrier Factors.* Finally, we do not report Conditional $R^2$ for any barrier model since the model did not converge, indicating that the difference between it and Marginal $R^2$ is negligible. This suggests that barriers do not significantly vary across work activities. Like our enabler scale models, this suggests that workplace attributes play a greater role in explaining the variance across barrier scales than work activities do.

## 5 Discussion

While significant work has studied what enables or presents a barrier to remote knowledge workers, researchers know little about what workers perceive as the most and least important factors to successful remote work and how workplace attributes affect those perceptions in remote work today. This understanding is fundamental as remote work practices have recently been adopted globally due to the COVID-19 pandemic and remain commonplace today. Through a large-scale survey based on prior research studying remote and hybrid teams and analysis, we uncover six themes of what workers, managers, and organizations should be cognizant of when working remotely. In the following section, we discuss these themes in connection with previous literature and provide practical implications for workers and managers in remote workplaces.

### 5.1 Personal Familiarity Matters Less

We found that familiarity within teams and collaborations has mixed effects on remote work. Prior work suggested that having met each other or having a personal connection is essential for developing and maintaining common ground [31, 94, 107]. However, respondents perceived *Having met your teammates in person* as the least enabling factor. Similarly, *Not knowing your teammates on a personal level* was seen as the least hindering factor. While this finding seems contrary to what

prior research on meeting in person prior to remote collaboration has suggested, recent research suggests that remote activities may be sufficient in developing common ground between distributed teams, where, before, in-person interaction was necessary [8, 123]. Highly coupled work activities also require more frequent communication, allowing teams to develop common ground as they collaborate [20]. While we did not measure how reliant on others an individual worker was, most respondents felt that all enabling conditions were more helpful when they communicated more frequently, with Technical Readiness and Collaboration Readiness as the highest.

In contrast, feeling like one has a place in the team matters for remote work. We found that newer teams found *Lacking a Sense of Belonging* to be a larger barrier than well-established teams. Feeling like one belongs and contributes to a team is an important aspect of team performance and may reduce turnover in the workplace [17]. While simply meeting in person may not be inherently beneficial, engaging in team-building exercises or off-site activities could help develop rapport and belonging within them as a whole. Similarly, visibility on one's work would help workers feel valued and have influence on the team's decisions [50, 62].

Practically, managers need not prioritize meeting in person but rather engaging in developing rapport and belonging during virtual individual and team meetings [91]. When meeting remotely, managers should actively welcome and greet new team members. Managers should encourage team members to ask questions, share ideas and best practices, and foster individual agency to encourage a sense of belonging. They should regularly ask what obstacles team members face and what resources they can provide to help them with their work. Individual workers should regularly reflect on what is working or not working with their work and monitor their feelings about their team—whether they feel seen, included, and acknowledged by their team.

### 5.2 Workers and Managers Value Different Factors

We found that what was helpful to workers sometimes differed from what managers wanted. Prior work showed that workers and managers often view remote work differently [90], with workers finding it equally productive and valuing flexibility while managers worry about distractions and limited opportunities for social learning [12]. Our findings showed some of these differences. For example, managers found Common Ground factors (e.g., meeting people in person; knowing what others are working on; knowing who can help) more helpful than non-managers, a significant aspect of which is knowing what others are working on. Corroborating this, junior and middle managers found the Coupling of Work factors (which measure autonomy and well-defined work) less necessary than skilled office workers. In contrast, workers who were not managers generally found micromanagement to be a strong barrier to their work. As prior research has shown, managers often feel remote work reduces what they monitor about workers and may tend to micromanage more, ultimately hindering workers [119]. Moreover, prior research showed that greater autonomy was correlated with greater well-being [102] and motivation [50] for software engineers, suggesting that managers' micromanagement needs may have impacts beyond workers' productivity. These differing perspectives can cause tensions between workers and their managers if unresolved.

Practically, we recommend that managers discuss the differences in views on remote work. While workers may want to use surveillance software (e.g., "bossware" for detecting procrastination [7] or non-work related factors, like body language [33]) and micromanage to increase their understanding of work process and sense of control, they should consider the negative impact this may have on their team' members' productivity [32, 33, 58]. They should actively seek to build with their team members when meeting so that they can better trust them when not. Individuals ought to know how their manager perceives remote work and actively foster trust and information sharing during meetings with their managers [91]. They should also share social learning experiences to alleviate managers' concerns that this is not happening.

## 5.3 Hybrid Teams Struggle More Than Virtual Teams

We found that mixtures of remote and in-person teams can struggle when working remotely. Prior work has shown that this mismatch in interaction modality can cause reduced participation and overlapping talking; even with technological systems that physically embody the remote speaker, the reduced participation effects remain [18]. Moreover, prior work on collocated distance has shown increased challenges in establishing common ground and managing sub-team dynamics in hybrid teams [43]. Our analysis seems consistent with these findings. We found that teams that worked in hybrid configurations on work activities found distractions to be a greater barrier than remote-only teams. Further, teams where not everyone shared the same meeting modality found the barriers to remote work greater in all barrier scales, except Access to Support and Coordination Challenges for those who worked with non-primary teams (Coordination Challenges (All)). To offset the challenges of remote work, hybrid teams will need to pay more attention to their collaboration processes and what makes them ineffective.

Practically, managers of hybrid teams ought to develop collaboration norms with their teams and ask sub-teams to do the same. Workers may set norms for what hours they will be available for collaborative work and the modality for such meetings. Individuals should share their preferences for modality and be open to compromise when creating norms and selecting meeting modalities, even if they are inconvenient or not preferred. Developing shared values helps an entire team align on how to progress work, be it in-person or remote [91].

## 5.4 Reliability of Tools to Support Work

While "Distance Matters" argued that Technical Readiness was a major factor in the adoption of new tools [84], recent work has shown that the issue is less about people's competency with technology and more about the *reliability* of tools [20]. Our results provide additional analysis of this idea. One example of this is video calling. Compared to teams that only met over a video call, those with hybrid elements to their team meetings found Technical Readiness to be *less* helpful. We hypothesize that rather than workers' inexperience with technology, "inconveniences" workers need to be aware of, like forgetting to unmute one's microphone, will be more prevalent in remote work [81]. Another example we found is that *Not having permission to access a shared document* was a strong barrier for many workers. As workplaces almost exclusively use cloud-based tools, the challenge of unclear access becomes a growing concern for workers [77, 116], and increases the potential for growing inequity in accessing shared artifacts [8]. In short, technological readiness becomes less an issue of whether workers can use certain tools and rather more about what situations to be wary of that could affect collaboration practices.

Practically, this suggests a shift in the focus of technological training that Olson and Olson proposed in their work. In modern workplaces, workers are generally proficient with the technology they need to work or have access to significant support to learn those technologies quickly. A bigger issue is the norms around technology use, such as ensuring only those speaking have unmuted microphones or access to collaborative artifacts. For these, we suggest that teams develop more explicit norms for the specific technologies they use and include those as part of onboarding processes when new members join. At the technology level, we envision ways to make "collaboration states" (i.e., who is speaking; who has access) clearer, such as by having warnings when multiple people speak, and echoes are heard [65], or ways to see file access across teams who are working on a project and warn users when people in a meeting may lack access. These technologies can also include simple affordances that allow the sharing of documents or ideas in a more ad-hoc manner that circumvents issues of access in the moment [66].

## 5.5   Norm Setting for Tightly Coupled Work

For tightly coupled work, establishing clear collaboration norms may alleviate the challenges created by flexible remote work arrangements. Tightly coupled work imposes interdependence among workers to complete tasks [84], such as when one worker needs output from another worker to begin their work or constant communication is necessary. Barriers to tightly coupled work can include whether workers have different hours when working or cannot simultaneously communicate in real-time when working on a task. However, our findings show that neither factor was a significant hindrance. Workers found *Having different work hours than my team* as one of the least hindering factors for remote work. This may be partly explained by our study's recruitment of U.S.-based knowledge workers, where the maximum timezone difference would be three hours (excluding Alaska and Hawaii). Even with different starting times, U.S. workers would still have sufficient overlapping work hours to coordinate work activities without working inconvenient hours in the evening or morning. Workers also reported that reduced visibility into their co-workers' work processes and progress (a barrier factor) was not a barrier for tightly coupled work. One reason is that effective teams develop better collaboration norms when working remotely. For example, Nguyen et al. showed how a distributed IBM software engineering team did not struggle with delays in communication and task completion since all team members were encouraged to promptly respond to requests and comments from remote teammates [83]. Beyond communication, norms can also include better structures for breaking up tasks and when to check in on progress [20]. Of note, however, is that negotiating norms can be time-consuming [20, 54]. Moreover, teams will continually need to re-evaluate these norms as collaborations progress for trust in each other, allowing workers to work effectively together and share information openly, to persist [5].

Setting remote collaboration norms is particularly important for less established or larger teams. We found that somewhat established or new teams generally found barriers more impactful than well-established ones, consistent with prior work showing how shared collaboration norms can reduce the negative impact of distance in remote work [35]. Interestingly, aspects of Collaboration Readiness (e.g., trusting teammates, sharing expectations and working norms, etc.) were *less* helpful to less established teams, suggesting that teams lacking work norms only realize their value once established. However, we also observed that as teams grew, remote work barriers increased. We posit this occurs because teams outgrow the norms they established when they were smaller. For example, a small team may not find channel-wide mentions disruptive when using workplace chat clients like Slack or Microsoft Teams due to limited usage. However, these practices become considerably more disruptive when frequently used in larger teams. Together, these findings suggest the value of teams developing and sharing norms for collaboration [25] and studying the design of tools to facilitate the norm-setting process for different teams.

Practically, we recommend that managers help larger and less established teams develop effective practices for dividing work, establishing internal deadlines and trade-off practices, and regular progress updates. With their teams, managers should establish regular windows of time when team members can communicate. Managers ought to create a climate of psychological safety [44] so that individuals feel comfortable asking for help if facing a barrier or likely to miss a deadline upon which a teammate is dependent. Individuals ought to be cognizant of the interferences of their work and how their work influences their teammates' productivity and work satisfaction. Moreover, managers should also help teams be more purposeful with meetings, focusing on having them be productive, motivating all participants to contribute, and acknowledging challenges with physical comfort when working remotely (e.g., norms and reminders for physical breaks from work when remote [70, 98]) [32]. Together, we envision these changes can help teams develop, foster, and maintain workplace norms that make them more productive and benefit their well-being [3].

## 5.6 Work Activities Are Less Important Than Workplace Attributes

A key hypothesis of our study was that knowledge workers who did different work activities would value different factors that help or hinder remote work. Inspired by work on task-technology fit [57], we thought work activities that, for example, required more creativity and co-creation would show a greater need for factors like Common Ground and Collaboration Readiness than providing feedback on a presentation or document. While our early analysis showed that some significant differences existed between work activities and our enabler and barrier scales, our mixed-effect models showed that the variance explained by work activities and workplace attributes together was only marginally higher than workplace attributes alone. In other words, workplace attributes played a more significant role in explaining what workers felt was important to doing remote work. While further research is necessary, this implies that less attention may be given to specific work activities (e.g., sales teams versus software engineers) compared to the workplace attributes highlighted above when deciding what is important in supporting remote and hybrid teams.

Practically, managers should pay greater attention to how people work when considering return-to-office policies. Recently, many managers have tried to bring back teams that, seemingly, can only work in person, such as sales teams. Our analysis suggests that it is less about the work people do and more about their work environment that makes remote work successful. Rather than making sweeping changes in work modality based only on the tasks people do, our work suggests that workplaces should more closely examine their work environments and make adjustments that allow workers to be remote, if desired and possible. Individuals should reflect on how they are more productive and satisfied with their work and communicate this to their manager.

## 6 Limitations and Future Research

We now discuss our work's limitations and suggest future research directions.

### 6.1 Methodological Limitations

First, our study analyzed self-reported data from workers without linking their responses to actual performance metrics. Further, since this is not an experimental study, we cannot claim causality among the studied factors and workplace configurations. Instead, we provide theoretical explanations for our findings, corroborating previously observed results at scale in remote workplaces. Future work may include performance measures and examining the workplace attributes we studied in an experimental setting. This approach would allow researchers to develop systems that help teams recognize potential issues with their work environment and attempt reconfigurations in practices, norms, or team structures to remedy them.

In our instrument, Common Ground and Coupling of Work had low internal consistency within their scales (0.47 and 0.41, respectively). For Common Ground, respondent ratings diverged significantly, with *Knowing who to ask for help* being the third most important overall, while the other two items were least important, contributing to the lower consistency. The Coupling of Work scale did not have as strong a difference, but it consisted of only two items. Rather than removing these items, we retained them because they represent important aspects that help form and maintain Common Ground for distributed teams, and capture the challenges of tightly coupled work. We recommend that future researchers add additional items to these scales to increase internal consistency.

While the workplace attributes we investigated have a significant influence on the enabler and barrier factors, as shown in Sections 4.2.1 and 4.2.2, they only explain a portion of the overall variance. The Marginal $R^2$ for our fixed effects (workplace attributes) ranged from 0.03 to 0.16, indicating other attributes likely play an important role in workers' perceptions of enablers and barriers. Future research should investigate additional workplace attributes and their role in supporting or

hindering remote work, including how structured work processes for tasks are (e.g., engineering processes) and the organization's culture around collaboration.

Finally, our survey only asked respondents about their most common work activity. Our study's goal was to garner large-scale participation. However, in testing, we found that asking about multiple work activities led to survey fatigue. Future studies may consider repeating the survey of the same worker but for different work activities in separate sessions. Alternatively, additional qualitative investigation of the differences in enabler and barrier factors may help understand the effects of work activities.

## 6.2 Empirical Limitations

Our survey focused exclusively on U.S.-based knowledge workers, which prevented us from examining the well-documented challenges of working across time zones [82, 84, 85], countries, and cultural differences [3, 27, 106]. We chose this population based on the panel of knowledge workers available through Qualtrics. Future work should expand our study to include teams from other countries and global teams to measure these temporal (i.e., working in significantly different or non-overlapping time zones) and cultural differences. Studying non-U.S.-based teams would help researchers understand what helps and hinders global remote collaboration and how they correlate with workplace attributes (e.g., hybrid and virtual teams worsen cultural challenges).

While we conducted initial analysis on the individual prompts, we did not find strong pairwise correlations (i.e., Spearman's $\rho < 0.5$) among enabler and barrier items. However, subgroups of correlated results may exist that we did not examine, such as two items correlating for managers but not individual contributors. Future research should explore such kinds of relationships further.

Future research should revisit technological readiness in light of new AI technologies being increasingly adopted in the workplace [15, 29]. AI tool use, especially large-language model-based generative systems that require extensive prompting, may require additional training for workers, similar to when workplaces introduced office software. Consequently, technological readiness may re-emerge as a critical skill—similar to what Olson and Olson studied—unlike for existing software.

Future research should also consider expanding into other important factors for remote work, such as accessibility challenges. Workers may have had greater access to jobs previously, which was impossible due to accessibility needs. However, differently-abled individuals need alternative support in the communication and productivity tools they use for remote work and in establishing collaboration norms in an ability-diverse team [6, 37, 75, 100, 103]. Future research should study what helps and hinders accessible remote work practices, similar to what we did, and how those needs intersect with the needs of other knowledge workers.

Similarly, future research should expand beyond remote knowledge work. We focused on complex, non-routine work, which requires significant collaboration and coordination. Historically, this has been more challenging to do across distance. However, as Gould et al. discuss, HCI and CSCW research predominantly emphasize knowledge work and gig work (e.g., research areas [38, 59, 73]; long-term experiences [22]; platform dynamics [71, 109]; pay discrepancy [49]; peer support [48, 122]; invisible labor [9, 114]), ignoring traditional work that may wish to adopt remote modalities [58]. By focusing only on knowledge work and gig work—which do not encompass other forms of computer-supported work, such as routine activities (e.g., bookkeeping)—researchers miss opportunities to understand effective remote work practices for a broader population of workers and their needs (e.g., having the right technology and training). Moving towards a world where remote work is more universally adopted will require understanding remote work practices beyond knowledge work that we, and the broader HCI community, have largely focused on.

Finally, workplaces are dynamic and will require researchers to revisit fundamental workplace research as workplaces evolve continually. Our findings represent workers' current perceptions

of remote work enablers and barriers following the significant shift towards remote and hybrid work arrangements caused by the COVID-19 pandemic. Such transformative shifts are not unprecedented. Historic examples include women entering the workforce during World War II driven by industrial mobilization, but being unable to keep their jobs in the downsizing following the war, bringing into question the gendered norms around work in society and women's involvement in the future workforce [96]; and the transition from manufacturing to knowledge work in offices driven by increased access to information technology [41], requiring re-skilling of many workers for office roles and the decline of manufacturing jobs in the U.S. [13]. As future shifts reshape work environments, researchers will need to reassess whether our existing ways of working remain effective in future workplaces.

## 7   Conclusion

Remote work is more prevalent than ever, requiring workers, managers, and organizations to rethink how we approach collaborative knowledge work. Our research examined workers' perceptions of key enablers and barriers to remote work across various work activities and workplace attributes (i.e., technologies, infrastructures, and collaboration practices). Through a theoretically informed survey of 1,526 U.S.-based knowledge workers, we found that: (1) personal familiarity between workers matters less than before; (2) workers and managers value different factors; (3) hybrid teams struggle more than virtual teams; (4) tool reliability is more important than tool proficiency; (5) tightly coupled work requires norm-setting in advance of the work; and (6) work activities are less important than workplace attributes. These findings enhance our understanding of how organizations can continue to support post-pandemic remote work practices with improved workplace infrastructure and collaboration norms. We envision these findings will inform future research on remote work effectiveness and organizational adoption of effective remote work policies.

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## A   Survey Instrument

Below is the final survey instrument deployed in our study. Question block and top-level questions appeared in the order below. Responses and sub-prompts (e.g., for enabler and barrier questions in A.5) were randomized. *Text in italics* is meant for the reader and not shown to respondents.

### A.1   Survey Introduction

Welcome, and thank you for checking out our survey! We want to understand what helps and prevents you from doing various work activities in your role. We will first ask a few questions about what you do, then ask details about what you find important to doing your work, and finally close with demographic information. This survey takes about 10 minutes to complete. Your responses will be kept confidential and be anonymized during analysis.

### A.2   Screener

*The screener section of the survey was used to filter for full-time, remote, or hybrid knowledge workers. [TERMINATE] indicates responses where a respondent would be filtered out when taking the survey.*

(1) Which best describes your responsibilities at work?
- Accounting and finance
- Arts [TERMINATE]
- Business development
- Business ownership [TERMINATE]
- Consulting
- Customer support
- Design
- Education [TERMINATE]
- Engineering, excluding software (e.g., Electrical, Civil, Mechanical)
- Healthcare services [TERMINATE]
- Human resources/recruiting
- IT and security
- Legal
- Marketing and brand management
- Media and communications
- Operations
- Product management
- Project or program management
- Research and/or data analysis
- Sales and product support
- Client and stakeholder relations
- Software development/software engineering
- Other (please specify) [TERMINATE]

(2) Which best describes your company's current industry?
- Agriculture [TERMINATE]
- Commercial Services
- Communications, Marketing, and PR
- Consumer Goods
- Education [TERMINATE]
- Energy and utilities
- Financial Services & Insurance

- Food & Beverage Services [TERMINATE]
- Government & Public Sector
- Healthcare and Pharmaceutical
- Information Technology (Hardware, Software, Services)
- Logistics
- Manufacturing & Industrial Equipment
- Media, Entertainment and Arts
- Mining & Materials [TERMINATE]
- Not-for-profit organization (Non-profit, NGO, and/or Charity)
- Professional Services (e.g., Legal, Consulting)
- Real Estate
- Retail
- Telecommunications
- Transportation
- Travel, Tourism & Hospitality
- Other (please specify) [TERMINATE]

(3) Which best describes your employment status?
- Full-time permanent employee
- Part-time permanent employee [TERMINATE]
- Full-time contractor [TERMINATE]
- Part-time contractor [TERMINATE]
- Not currently employed [TERMINATE]
- Other (please specify) [TERMINATE]

(4) What is your current or most recent role?
- Executive Management (e.g., President / Partner, CEO, CFO, C-Suite)
- Senior Management (e.g., Executive VP, Senior VP)
- Middle Management (e.g., Department / Group Manager, VP)
- Junior Management (e.g., Manager, Team Leader)
- Non-Management Senior Staff (e.g., Senior Analyst; Senior Designer)
- Skilled Office Worker (e.g., Analyst, Graphic Designer)
- General Staff (e.g., Receptionist, Cashier) [TERMINATE]
- Skilled Manual Worker (e.g., Tradesperson, Craftsperson) [TERMINATE]
- Semi-Skilled Worker or Laborer (e.g., Factory Worker, Truck Driver) [TERMINATE]
- Other (please specify) [TERMINATE]

(5) Think about your last typical work week. Please select the statement that best describes where you worked.
- I only worked in a remote location away from the office (e.g., my home)
- I split my time between a remote location and the company's or client's location (e.g., my company's or client's office)
- I only worked at my company's or client's location. [TERMINATE]

## A.3 Picking the most common collaborative work activity

*Since we were quota-ing on the Work Activity respondents did, anyone responding with "Other" was terminated from the survey; respondents were also terminated from the survey if they selected a work activity whose quota had been reached.*

(1) Please enter the job title for your current role (e.g., Senior Manager, Client Relations; Associate Sales Manager).

- [text entry, single-line]

(2) Please select the most common work activity you do **when working with collaborators remotely** (e.g., a product manager may track project status or review customer feedback).
  - *Acquisition: gathering information to solve a problem.*
    - Generating ideas for a new product, services, or strategies
  - *Analysis: critically thinking about something to understand it.*
    - Designing new products, services, or strategies
    - Gathering and analyzing user or customer feedback (via surveys, interviews, etc.)
  - *Authoring: creation of content / informational object.*
    - Writing documents, articles, and/or presentations
    - Building new products, services, or strategies
  - *Co-authoring: collaborative creation of content.*
    - Troubleshooting or collaborative problem solving
  - *Dissemination: spreading information or results to relevant audiences.*
    - Presenting or distributing information
  - *Feedback: assessment of an informational object (e.g., document, proposal, presentation).*
    - Getting and providing feedback
  - *Searching for resources: finding information or people that can help solve a problem.*
    - Asking and answering questions
  - *Learning: acquiring new knowledge, skills, or understanding for executing work.*
    - Providing or receiving professional development (e.g., training, conferences, mentorship)
  - *Monitoring and Planning-related tasks: developing plans and keeping oneself up-to-date on their progress.*
    - Planning a project
    - Tracking project progress and updating status reports
  - *Networking: interacting with other people and organizations to exchange information and develop contacts.*
    - Building team cohesion
  - Other (please specify) [TERMINATE]

(3) How would you describe your ability to work on **[work activity]** remotely?
  - 1: Poor, 2: Fair, 3: Good, 4: Very good, 5: Excellent

## A.4 Information About How Work Activities Are Done

We'll now ask questions about with whom, where, and how you do: **[work activity]**. In answering these questions, consider the last typical time you did this activity. For instance, if you attended the last all-hands meeting in person but would normally do it remotely, please consider the latter as the typical way you do the activity.

(1) When you do **[work activity]**, who else is involved? Select all that apply.
  - Co-workers on my primary team (i.e., the small group of people you work with most closely at your company)
  - Internal co-workers who are not on my primary team (e.g., product development team if you are on a software engineering team)
  - External customers, clients, partners, or people that do not work at my company
  - Other (please describe):

For the rest of the survey, "team" will refer to the group of 2 or more people you typically do **[work activity]** with. For example, these could include human-resources people; a product team working

with a marketing team in the same company; or an Account Manager working with a client from a different company.

(2) When you work on **[work activity]**, about how many people do you work with in total?
   - Only me
   - 2-3 people
   - 4-6 people
   - 7-8 people
   - 9-10 people
   - 11-15 people
   - More than 15 people

(3) How long have you worked with your team for **[work activity]**?
   - We just formed the team.
   - We've been working together for a few weeks.
   - We've worked together for several months or longer.

(4) When working on **[work activity]**, how often do you communicate with your team?
   - Several times per hour
   - Many times per day
   - A few times per day
   - A few times per week
   - Around once a week
   - Less than once per week

(5) For **[work activity]**, which of the following best describes when your team is expected to work?
   - People on my team are generally expected to work the same schedule as everyone else on the team (e.g., 9 am to 5 pm, Eastern Time), even if they're in a different time zone.
   - People on my team are generally expected to work standard business hours for where they are (e.g., 9 am to 5 pm, but in different time zones).
   - People on my team are expected to overlap for a small number of "core collaboration hours" most days, but are otherwise free to choose their working hours (e.g., 11am-2pm in one time zone, otherwise free).
   - There are no expectations for when people on my team are expected to work - they can work whenever they choose, with no coordination about "standard" working hours.
   - Other (please describe)

(6) How frequently do you use the following communication tools when doing **[work activity]**?
   - Scale:
     - 1: Never, 2: Less than monthly, 3: Monthly, 4: Every 2 weeks, 5: Weekly, 6: Daily
   - Communication tool:
     - Slack
     - Microsoft Teams
     - Gmail
     - Microsoft Outlook
     - Zoom video conferencing
     - Cisco Webex video conferencing
     - Google Meet
     - Phone Calls
     - Other messaging or video conferencing platform not listed here
     - Other email platform not listed here

(7) How frequently do you use the following productivity tools when doing **[work activity]**?
- Scale:
  - 1: Never, 2: Less than monthly, 3: Monthly, 4: Every 2 weeks, 5: Weekly, 6: Daily
- Productivity tool:
  - Project management tools (e.g., Jira, Trello, Asana)
  - Office software (e.g., Microsoft Office, Google Docs)
  - Design software (e.g., Figma, Adobe Photoshop or Illustrator)
  - Sales software (e.g., CRMs)

(8) When working on **[work activity]**, where does your team typically work?
- In-person (e.g., at our company's or client's office)
- Hybrid (e.g., at least 2 people are together at an office, while others work remotely)
- Remotely (e.g., everyone works on the activity away from the office)

(9) When working on **[work activity]**, which of the following best describes how you use video conferencing software, like Zoom, when meeting with collaborators?
- We don't use video conferencing software because we usually meet together in person (e.g. in a company office).
- Most people meet together / in-person, but a few people may participate via video conferencing software.
- Most people participate via video conferencing software, but a few people may meet together / in-person.
- Everyone usually participates via video conferencing software, regardless of where they're working.
- Not applicable.

(10) When working on **[work activity]**, how do you collaborate with your team?
- We work at the same time while communicating through video calls, phone calls, or a messaging service (e.g., Microsoft Teams; Slack).
- We work at the same time, but are not communicating with each other while working.
- We work at different times and routinely meet to sync up on progress.

## A.5 Enablers and Barriers of Work Activity

We'll now ask what <u>helps</u> and what <u>prevents</u> you from: **[work activity]**. When answering each prompt, please try to reflect on **the specific work activity above, not about working remotely in general.** Please answer to the best of your understanding of what we're asking you. Feel free to select, "Not applicable to me", if the statement is not relevant.

As a reminder, "team" refers to the group of 2 or more people you typically do the activity above. For example, these could include human-resources people; a product team working with a marketing team in the same company; or an Account Manager working with a client from a different company.

(1) How much does the following help you when: **[work activity]**?
- Scale:
  - 0: Not applicable to me, 1: Not at all helpful, 2: Slightly helpful, 3: Moderately helpful, 4: Very helpful, 5: Extremely helpful
- Prompts, presented in a random order one at a time:
  - *Common ground*
    * Knowing what others are working on.
    * Knowing who to ask for help if a problem comes up.
    * Having met my teammates in-person before.

– *Collaboration readiness*
  * Teammates sharing work progress and obstacles.
  * Sharing the same expectations of work quality.
  * Trusting my teammates' motives.
  * Trusting my teammates' ability to do the work.
  * Understanding how my team likes to communicate and work together.
  * Willingness to share helpful information with each other.
  * Feeling connected to my teammates.
– *Technical readiness*
  * Having the tools I need.
  * Being able to change tools when necessary.
  * Sharing the same set of tools across my team.
  * Sharing the same norms for using the tools in my team.
– *Coupling of work*
  * Having clear, well-defined steps.
  * Being able to work autonomously.
– *Organizational and management factors*
  * Knowing the hierarchy of who reports to whom.
  * Transparency on why management wants me to do the work activity.
  * Managers trust us to get the work activity done.
  * Managers help establish communication norms when doing the activity.
(2) How much does the following pose a barrier to: **[work activity]**?
  • Scale:
    – 0: Not applicable to me, 1: Not a barrier, 2: Slight barrier, 3: Moderate barrier, 4: Large barrier, 5: Extreme barrier
  • Prompts, presented in a random order, one at a time:
    – *Sense of belonging*
      * Feeling isolated from my co-workers.
      * Feeling unsure if I'm contributing to the work activity.
      * Not knowing my teammates on a personal level.
      * Fears of being less effective than my teammates.
      * Feeling like I don't belong on the team.
    – *Distractions/ability to focus*
      * Lacking a quiet place to work.
      * Having personal caregiving responsibilities (e.g., childcare).
      * Having too many meetings for the activity.
      * Difficulty in setting boundaries between work and life.
      * Being interrupted by teammates.
    – *Access to support*
      * Lacking resources to resolve problems that come up.
      * Lacking training on procedures or tools for the work activity.
      * Missing informal check-ins and feedback opportunities.
    – *Flexibility / agency*
      * Struggling to prioritize the activity against others.
      * Being micromanaged in how I do the activity.
    – *Lack of visibility*
      * Not knowing who is available to work on the activity.
      * Not knowing what work progress has been made.

– *Coordination challenges*
  * Not having permission to access a shared document.
  * Being dependent on my teammates' work to do my work.
  * Being unable to whiteboard or sketch out ideas together in real time.
  * Having different work hours than my team.
  * Lack of a dedicated project manager.
  * *[if inter-team work or external work in the first question of A.4]* Keeping multiple teams aligned on work progress and obstacles.
  * *[if inter-team work or external work in the first question of A.4]* Different teams using unfamiliar jargon or technical terms.

## A.6 Demographic Information

(1) About how many years have you worked professionally? For increments less than a year, please use decimals (e.g., 0.25; 0.50).
  • Numeric Text Entry: 0-99, decimals up to 2 places
(2) About how many years have you worked at your current role? For increments less than a year, please use decimals (e.g., 0.25; 0.50).
  • Numeric Text Entry: 0-99, decimals up to 2 places
(3) What is your age?
  • Numeric Text Entry: 18-99
(4) What is your gender?
  • Man
  • Woman
  • Non-binary
  • Prefer not to say

## B  Demographic differences between U.S. Population and Survey Sample

Table 6 shows the differences between the gender and age of U.S. knowledge workers and our survey's sample. While census data for knowledge workers is not available, we approximate their population using "college-educated" adults, since most college-educated workers are knowledge workers and most knowledge workers have a college-level education.

Table 6. Proportions in gender and age brackets between the U.S. population and the survey sample.

| Gender | Age bracket | Population | Survey Sample | Difference |
|--------|-------------|------------|---------------|------------|
| Female | 20-34 | 0.1610 | 0.2000 | -0.0390 |
| Female | 35-49 | 0.1830 | 0.2480 | -0.0650 |
| Female | 50-64 | 0.1360 | 0.1140 | 0.0220 |
| Female | 65+ | 0.0300 | 0.0105 | 0.0195 |
| Male | 20-34 | 0.1380 | 0.1100 | 0.0280 |
| Male | 35-49 | 0.1720 | 0.2200 | -0.0480 |
| Male | 50-64 | 0.1380 | 0.0754 | 0.0626 |
| Male | 65+ | 0.0430 | 0.0144 | 0.0286 |

## C  Survey Summary Statistics

Summary statistics are presented in the same order as the survey questions in Appendix A.2.

## C.1   Screener Section

Table 7.  Which best describes your responsibilities at work?

| Responsibilities at Work | Count (Percent) |
| --- | --- |
| Operations | 144 (9.44%) |
| Customer support | 139 (9.11%) |
| Accounting and finance | 157 (10.29%) |
| Product management | 37 (2.42%) |
| Sales and product support | 75 (4.91%) |
| Research and/or data analysis | 47 (3.08%) |
| IT and security | 251 (16.45%) |
| Software development / software engineering | 62 (4.06%) |
| Human resources / recruiting | 131 (8.58%) |
| Engineering, excluding software (e.g., Electrical, Civil, Mechanical) | 63 (4.13%) |
| Consulting | 47 (3.08%) |
| Project or program management | 70 (4.59%) |
| Legal | 37 (2.42%) |
| Design | 36 (2.36%) |
| Business development | 57 (3.74%) |
| Marketing and brand management | 59 (3.87%) |
| Media and communications | 20 (1.31%) |
| Client and stakeholder relations | 23 (1.51%) |
| Other (please specify in the next question) | 71 (4.65%) |

Table 8.  Which best describes your company's current industry?

| Industry | Count (Percent) |
| --- | --- |
| Financial Services & Insurance | 255 (16.71%) |
| Manufacturing & Industrial Equipment | 102 (6.68%) |
| Government & Public Sector | 73 (4.78%) |
| Healthcare and Pharmaceutical | 96 (6.29%) |
| Not-for-profit organization (Non-profit, NGO, and/or Charity) | 55 (3.60%) |
| Retail | 87 (5.70%) |
| Real Estate | 57 (3.74%) |
| Media, Entertainment and Arts | 41 (2.69%) |
| Consumer Goods | 59 (3.87%) |
| Professional Services (e.g., Legal, Consulting) | 105 (6.88%) |
| Information Technology (Hardware, Software, Services) | 278 (18.22%) |
| Energy and utilities | 37 (2.42%) |
| Travel, Tourism & Hospitality | 21 (1.38%) |
| Telecommunications | 38 (2.49%) |
| Communications, Marketing and PR | 38 (2.49%) |
| Transportation | 33 (2.16%) |
| Commercial Services | 26 (1.70%) |
| Logistics | 26 (1.70%) |
| Other (please specify in the next question) | 99 (6.49%) |

Table 9. Which best describes your employment status?

| Working Status | Count (Percent) |
|---|---|
| Full-time permanent employee | 1526 (100.00%) |

Table 10. What is your current or most recent role?

| Job Role | Count (Percent) |
|---|---|
| Skilled Office Worker (e.g., Analyst, Graphic Designer) | 286 (18.74%) |
| Non-Management Senior Staff (e.g., Senior Analyst; Senior Designer) | 212 (13.89%) |
| Junior Management (e.g., Manager, Team Leader) | 233 (15.27%) |
| Middle Management (e.g., Department / Group Manager, Director) | 463 (30.34%) |
| Senior Management (e.g., VP, Senior VP) | 170 (11.14%) |
| Executive Management (e.g., President / Partner, CEO, CFO, C-Suite) | 162 (10.62%) |

Table 11. Think about your last typical work week. Please select the statement that best describes where you worked.

| Work Location | Count (Percent) |
|---|---|
| I split my time between a remote location and the company's or client's location (e.g., my company's or client's office) | 1007 (65.99%) |
| I only worked in a remote location away from the office (e.g., my home) | 519 (34.01%) |

## C.2 Work Activity

Table 12. Please select the most common work activity you do when working with collaborators remotely (e.g., a product manager may track project status or review customer feedback).

| Work Activity | Count (Percent) |
|---|---|
| Generating ideas for a new product, services, or strategies | 113 (7.40%) |
| Designing new products, services, or strategies | 121 (7.93%) |
| Gathering and analyzing user or customer feedback (via surveys, interviews, etc.) | 119 (7.80%) |
| Writing documents, articles, and/or presentations | 103 (6.75%) |
| Building new products, services, or strategies | 113 (7.40%) |
| Troubleshooting or collaborative problem solving | 133 (8.72%) |
| Presenting or distributing information | 124 (8.13%) |
| Getting and providing feedback | 101 (6.62%) |
| Asking and answering questions | 129 (8.45%) |
| Providing or receiving professional development (e.g., trainings, conferences, mentorship) | 117 (7.67%) |
| Planning a project | 116 (7.60%) |
| Tracking project progress and updating status reports | 136 (8.91%) |
| Building team cohesion | 101 (6.62%) |

Table 13. How would you describe your ability to work on [work activity] remotely?

| Remote Comfort | Count (Percent) |
|---|---|
| Excellent | 762 (49.93%) |
| Very good | 602 (39.45%) |
| Good | 132 (8.65%) |
| Fair | 23 (1.51%) |
| Poor | 7 (0.46%) |

## C.3 Workplace Attributes

Table 14. When you do [work activity], who else is involved? Select all that apply.

| Team Structure | Count (Percent) |
|---|---|
| Co-workers on my primary team | 570 (37.35%) |
| Internal co-workers who are not on my primary team | 136 (8.91%) |
| External customers, clients, partners, or people that do not work at my company | 81 (5.31%) |
| Co-workers on my primary team; Internal co-workers who are not on my primary team | 288 (18.87%) |
| Co-workers on my primary team; External customers, clients, partners, or people that do not work at my company | 173 (11.34%) |
| Internal co-workers who are not on my primary team; External customers, clients, partners, or people that do not work at my company | 35 (2.29%) |
| Co-workers on my primary team; Internal co-workers who are not on my primary team; External customers, clients, partners, or people that do not work at my company | 233 (15.27%) |
| Other: please specify below | 4 (0.26%) |
| Co-workers on my primary team; Other: please specify below | 3 (0.20%) |
| Co-workers on my primary team; Internal co-workers who are not on my primary team; Other: please specify below | 2 (0.13%) |
| Co-workers on my primary team; External customers, clients, partners, or people that do not work at my company; Other: please specify below | 1 (0.07%) |

Table 15. When you work on [work activity], about how many people do you work with in total?

| Team Size | Count (Percent) |
|---|---|
| Only me | 45 (2.95%) |
| 2-3 people | 367 (24.05%) |
| 4-6 people | 439 (28.77%) |
| 7-8 people | 245 (16.06%) |
| 9-10 people | 191 (12.52%) |
| 11-15 people | 101 (6.62%) |
| More than 15 people | 138 (9.04%) |

Table 16. How long have you worked with your team for [work activity]?

| Team Tenure | Count (Percent) |
|---|---|
| We've worked together for several months or longer. | 1145 (75.03%) |
| We've been working together for a few weeks. | 283 (18.55%) |
| We just formed the team. | 98 (6.42%) |

Table 17. When working on [work activity], how often do you communicate with your team?

| Team Comm Freq | Count (Percent) |
|---|---|
| Less than once per week | 14 (0.92%) |
| Around once a week | 76 (4.98%) |
| A few times per week | 318 (20.84%) |
| A few times per day | 408 (26.74%) |
| Many times per day | 556 (36.44%) |
| Several times per hour | 154 (10.09%) |

Table 18. For [work activity], which of the following best describes when your team is expected to work?

| Team Work Hours | Count (Percent) |
|---|---|
| People on my team are generally expected to work the same schedule as everyone else on the team, even if they're in a different time zone. | 513 (33.62%) |
| People on my team are generally expected to work standard business hours for where they are. | 569 (37.29%) |
| People on my team are expected to overlap for a small number of "core collaboration hours" most days, but are otherwise free to choose their working hours. | 327 (21.43%) |
| There are no expectations for when people on my team are expected to work. | 106 (6.95%) |
| Other: please specify below. | 11 (0.72%) |

Table 19. How frequently do you use the following communication or productivity tools when doing [work activity]

| Tool | Never | Less than monthly | Monthly | Every 2 weeks | Weekly | Daily |
|---|---|---|---|---|---|---|
| Comm Tool Use — Slack | 876 (57.40%) | 87 (5.70%) | 86 (5.64%) | 113 (7.40%) | 172 (11.27%) | 192 (12.58%) |
| Comm Tool Use — Microsoft Teams | 202 (13.24%) | 71 (4.65%) | 79 (5.18%) | 116 (7.60%) | 365 (23.92%) | 693 (45.41%) |
| Comm Tool Use — Gmail | 536 (35.12%) | 49 (3.21%) | 36 (2.36%) | 61 (4.00%) | 216 (14.15%) | 628 (41.15%) |
| Comm Tool Use — Microsoft Outlook | 150 (9.83%) | 53 (3.47%) | 68 (4.46%) | 105 (6.88%) | 281 (18.41%) | 869 (56.95%) |
| Comm Tool Use — Zoom | 308 (20.18%) | 149 (9.76%) | 180 (11.80%) | 157 (10.29%) | 454 (29.75%) | 278 (18.22%) |
| Comm Tool Use — Cisco Webex | 773 (50.66%) | 126 (8.26%) | 123 (8.06%) | 134 (8.78%) | 236 (15.47%) | 134 (8.78%) |
| Comm Tool Use — Google Meet | 721 (47.25%) | 113 (7.40%) | 115 (7.54%) | 98 (6.42%) | 302 (19.79%) | 177 (11.60%) |
| Comm Tool Use — Phone Calls | 118 (7.73%) | 90 (5.90%) | 64 (4.19%) | 81 (5.31%) | 351 (23.00%) | 822 (53.87%) |
| Comm Tool Use — Other Messaging / Video | 841 (55.11%) | 144 (9.44%) | 89 (5.83%) | 95 (6.23%) | 166 (10.88%) | 191 (12.52%) |
| Comm Tool Use — Other Email | 984 (64.48%) | 110 (7.21%) | 63 (4.13%) | 62 (4.06%) | 118 (7.73%) | 189 (12.39%) |
| Prod Tool Use — Proj Management | 502 (32.90%) | 91 (5.96%) | 93 (6.09%) | 106 (6.95%) | 355 (23.26%) | 379 (24.84%) |
| Prod Tool Use — Office Software | 33 (2.16%) | 13 (0.85%) | 49 (3.21%) | 74 (4.85%) | 290 (19.00%) | 1067 (69.92%) |
| Prod Tool Use — Design Software | 459 (30.08%) | 112 (7.34%) | 140 (9.17%) | 123 (8.06%) | 375 (24.57%) | 317 (20.77%) |
| Prod Tool Use — Sales Software | 558 (36.57%) | 58 (3.80%) | 109 (7.14%) | 130 (8.52%) | 318 (20.84%) | 353 (23.13%) |

Table 20. When working on [work activity], where does your team typically work?

| Work Activity Location | Count (Percent) |
| --- | --- |
| Remotely (e.g., everyone works on the activity away from the office) | 428 (28.05%) |
| Hybrid (e.g., at least 2 people are together at an office, while others work remotely) | 916 (60.03%) |
| In-person (e.g., at our company's or client's office) | 182 (11.93%) |

Table 21. When working on [work activity], which of the following best describes how you use video conferencing software, like Zoom, when meeting with collaborators?

| Team Meeting Modality | Count (Percent) |
| --- | --- |
| Everyone usually participates via video conferencing software, regardless of where they're working. | 616 (40.37%) |
| Most people participate via video conferencing software, but a few people may meet together / in-person. | 494 (32.37%) |
| Most people meet together / in-person, but a few people may participate via video conferencing software. | 343 (22.48%) |
| We don't use video conferencing software because we usually meet together in person (e.g. in a company office). | 48 (3.15%) |
| Not applicable. | 25 (1.64%) |

Table 22. When working on [work activity], how do you collaborate with your team?

| Work Activity Sync-ness | Count (Percent) |
| --- | --- |
| We work at the same time while communicating through video calls, phone calls, or a messaging service (e.g., Microsoft Teams; Slack). | 957 (62.71%) |
| We work at the same time, but are not communicating with each other while working. | 218 (14.29%) |
| We work at different times and routinely meet to sync up on progress. | 351 (23.00%) |

## C.4   Enablers and Barriers

Table 23.  How much does the following help you when: [work activity]?

| Enabler | Not applicable | Not at all helpful | Slightly helpful | Moderately helpful | Very helpful | Extremely helpful |
|---|---|---|---|---|---|---|
| Knowing what others are working on | 11 (0.72%) | 33 (2.16%) | 136 (8.91%) | 322 (21.10%) | 569 (37.29%) | 455 (29.82%) |
| Knowing who to ask for help if a problem comes up | 2 (0.13%) | 6 (0.39%) | 46 (3.01%) | 161 (10.55%) | 515 (33.75%) | 796 (52.16%) |
| Having met my teammates in-person before | 57 (3.74%) | 109 (7.14%) | 225 (14.74%) | 286 (18.74%) | 448 (29.36%) | 401 (26.28%) |
| Teammates sharing work progress and obstacles | 5 (0.33%) | 9 (0.59%) | 62 (4.06%) | 229 (15.01%) | 611 (40.04%) | 610 (39.97%) |
| Sharing the same expectations of work quality | 3 (0.20%) | 6 (0.39%) | 53 (3.47%) | 199 (13.04%) | 617 (40.43%) | 648 (42.46%) |
| Trusting my teammates' motives | 12 (0.79%) | 7 (0.46%) | 86 (5.64%) | 223 (14.61%) | 604 (39.58%) | 594 (38.93%) |
| Trusting my teammates' ability to do the work | 5 (0.33%) | 9 (0.59%) | 56 (3.67%) | 175 (11.47%) | 558 (36.57%) | 723 (47.38%) |
| Understanding how my team likes to communicate and work together | 5 (0.33%) | 6 (0.39%) | 50 (3.28%) | 206 (13.50%) | 614 (40.24%) | 645 (42.27%) |
| Willingness to share helpful information with each other | 3 (0.20%) | 7 (0.46%) | 45 (2.95%) | 152 (9.96%) | 526 (34.47%) | 793 (51.97%) |
| Feeling connected to my teammates | 7 (0.46%) | 20 (1.31%) | 101 (6.62%) | 275 (18.02%) | 586 (38.40%) | 537 (35.19%) |
| Having the tools I need | 2 (0.13%) | 3 (0.20%) | 44 (2.88%) | 144 (9.44%) | 429 (28.11%) | 904 (59.24%) |
| Being able to change tools when necessary | 13 (0.85%) | 19 (1.25%) | 103 (6.75%) | 294 (19.27%) | 611 (40.04%) | 486 (31.85%) |
| Sharing the same set of tools across my team | 7 (0.46%) | 12 (0.79%) | 85 (5.57%) | 244 (15.99%) | 550 (36.04%) | 628 (41.15%) |
| Sharing the same norms for using the tools in my team | 15 (0.98%) | 12 (0.79%) | 91 (5.96%) | 302 (19.79%) | 630 (41.28%) | 476 (31.19%) |
| Having clear, well-defined steps | 1 (0.07%) | 5 (0.33%) | 51 (3.34%) | 175 (11.47%) | 520 (34.08%) | 774 (50.72%) |
| Being able to work autonomously | 14 (0.92%) | 27 (1.77%) | 66 (4.33%) | 243 (15.92%) | 559 (36.63%) | 617 (40.43%) |
| Knowing the hierarchy of who reports to whom | 15 (0.98%) | 29 (1.90%) | 106 (6.95%) | 318 (20.84%) | 548 (35.91%) | 510 (33.42%) |
| Transparency on why management wants me to do the work activity | 12 (0.79%) | 14 (0.92%) | 70 (4.59%) | 287 (18.81%) | 539 (35.32%) | 604 (39.58%) |
| Managers trust us to get the work activity done | 9 (0.59%) | 12 (0.79%) | 53 (3.47%) | 180 (11.80%) | 519 (34.01%) | 753 (49.34%) |
| Managers help establish communication norms when doing the activity | 14 (0.92%) | 21 (1.38%) | 91 (5.96%) | 271 (17.76%) | 600 (39.32%) | 529 (34.67%) |

Table 24. How much does the following pose a barrier to: [work activity]?

| Barrier | Not asked | Not applicable | Not a barrier | Slight barrier | Moderate barrier | Large barrier | Extreme barrier |
|---|---|---|---|---|---|---|---|
| Feeling isolated from my co-workers | 0 | 62 (4.06%) | 488 (31.98%) | 343 (22.48%) | 302 (19.79%) | 217 (14.22%) | 114 (7.47%) |
| Feeling unsure if I'm contributing to the work activity | 0 | 75 (4.91%) | 431 (28.24%) | 318 (20.84%) | 344 (22.54%) | 244 (15.99%) | 114 (7.47%) |
| Not knowing my team-mates on a personal level | 0 | 60 (3.93%) | 520 (34.08%) | 392 (25.69%) | 290 (19.00%) | 163 (10.68%) | 101 (6.62%) |
| Fears of being less effec-tive than my teammates | 0 | 66 (4.33%) | 461 (30.21%) | 346 (22.67%) | 318 (20.84%) | 217 (14.22%) | 118 (7.73%) |
| Feeling like I don't belong on the team | 0 | 131 (8.58%) | 468 (30.67%) | 251 (16.45%) | 249 (16.32%) | 250 (16.38%) | 177 (11.60%) |
| Lacking a quiet place to work | 0 | 90 (5.90%) | 484 (31.72%) | 290 (19.00%) | 302 (19.79%) | 210 (13.76%) | 150 (9.83%) |
| Having personal caregiv-ing responsibilities (e.g., childcare) | 0 | 224 (14.68%) | 378 (24.77%) | 295 (19.33%) | 300 (19.66%) | 214 (14.02%) | 115 (7.54%) |
| Having too many meet-ings for the activity | 0 | 51 (3.34%) | 293 (19.20%) | 338 (22.15%) | 361 (23.66%) | 294 (19.27%) | 189 (12.39%) |
| Difficulty in setting boundaries between work and life | 0 | 44 (2.88%) | 391 (25.62%) | 293 (19.20%) | 367 (24.05%) | 274 (17.96%) | 157 (10.29%) |
| Being interrupted by teammates | 0 | 34 (2.23%) | 365 (23.92%) | 390 (25.56%) | 379 (24.84%) | 215 (14.09%) | 143 (9.37%) |
| Lacking resources to resolve problems that come up | 0 | 46 (3.01%) | 251 (16.45%) | 242 (15.86%) | 322 (21.10%) | 394 (25.82%) | 271 (17.76%) |
| Lacking training on procedures or tools for the work activity | 0 | 60 (3.93%) | 273 (17.89%) | 270 (17.69%) | 321 (21.04%) | 334 (21.89%) | 268 (17.56%) |
| Missing informal check-ins and feedback opportu-nities | 0 | 48 (3.15%) | 315 (20.64%) | 362 (23.72%) | 378 (24.77%) | 285 (18.68%) | 138 (9.04%) |
| Struggling to prioritize the activity against others | 0 | 55 (3.60%) | 314 (20.58%) | 355 (23.26%) | 390 (25.56%) | 287 (18.81%) | 125 (8.19%) |
| Being micromanaged in how I do the activity | 0 | 97 (6.36%) | 293 (19.20%) | 248 (16.25%) | 285 (18.68%) | 283 (18.55%) | 320 (20.97%) |
| Not knowing who is available to work on the activity | 0 | 57 (3.74%) | 291 (19.07%) | 307 (20.12%) | 393 (25.75%) | 310 (20.31%) | 168 (11.01%) |
| Not knowing what work progress has been made. | 0 | 42 (2.75%) | 234 (15.33%) | 307 (20.12%) | 388 (25.43%) | 337 (22.08%) | 218 (14.29%) |
| Not having permission to access a shared document | 0 | 74 (4.85%) | 276 (18.09%) | 257 (16.84%) | 301 (19.72%) | 332 (21.76%) | 286 (18.74%) |
| Being dependent on my teammates' work to do my work | 0 | 67 (4.39%) | 290 (19.00%) | 341 (22.35%) | 365 (23.92%) | 266 (17.43%) | 197 (12.91%) |
| Being unable to white-board or sketch out ideas together in real time | 0 | 68 (4.46%) | 488 (31.98%) | 362 (23.72%) | 311 (20.38%) | 192 (12.58%) | 105 (6.88%) |
| Having different work hours than my team | 0 | 81 (5.31%) | 483 (31.65%) | 362 (23.72%) | 321 (21.04%) | 186 (12.19%) | 93 (6.09%) |
| Lack of a dedicated project manager | 0 | 104 (6.82%) | 377 (24.71%) | 229 (15.01%) | 318 (20.84%) | 305 (19.99%) | 193 (12.65%) |
| Keeping multiple teams aligned on work progress and obstacles | 577 (37.81%) | 39 (2.56%) | 191 (12.52%) | 218 (14.29%) | 280 (18.35%) | 160 (10.48%) | 61 (4.00%) |
| Different teams using unfamiliar jargon or technical terms | 577 (37.81%) | 30 (1.97%) | 201 (13.17%) | 195 (12.78%) | 230 (15.07%) | 182 (11.93%) | 111 (7.27%) |

## C.5  Demographics

Table 25.  Summary statistics of time working professionally, time in current role, and age in years.

| Question | Minimum | Median | Maximum | Mean | Std. Dev. |
|---|---|---|---|---|---|
| About how many years have you worked professionally? | 0.10 | 12.83 | 52.50 | 15.12 | 10.54 |
| About how many years have you worked at your current role? | 0.02 | 4.00 | 45.00 | 6.12 | 5.85 |
| What is your age? | 18.00 | 39.00 | 72.00 | 40.71 | 10.83 |

Table 26.  What is your gender?

| Gender | Count (Percent) |
|---|---|
| Man | 642 (42.07%) |
| Woman | 876 (57.40%) |
| Non-Binary | 3 (0.20%) |
| Prefer not to say | 5 (0.33%) |