Mastering Hybrid Work: A Practical Guide for Software Engineers

Author 1
author1@email.com
University 1
City 1, City 1, Country 1

Author 2
author2@email.com
University 2
City 2, City 2, Country 2

Author 3
author3@email.com
University 3
City 3, City 3, Country 3

Author 4
author4@email.com
University 4
City 4, City 4, Country 4

Author 5
author5@email.com
University 5
City 5, City 5, Country 5

ABSTRACT

In the middle of the emergence of the COVID-19 pandemic, hybrid software development teams have notably gained prominence. However, coordinating these teams unveils many challenges, mainly around effective communication, the setup of a good working environment, and cooperative practices. To contribute to this field, we carried out a study to identify practices for managing hybrid software development teams within the IT department of a Brazilian multinational company. The study was in an industry-academia collaboration and was structured into three stages: (1) a multivocal literature review, (2) a case study containing discursive textual analysis through semi-structured interviews and non-participant observation (previously published), and (3) a focus group for the formulation of a collaborative practices guide. For the focus group, we recruited 11 software engineers from eight software teams. The study resulted in 23 practices categorized into three dimensions: people, processes, and spaces. We believe the practices can contribute to the growing knowledge of managing hybrid teams. The resultant guide also contributes to disseminating hybrid work strategies to the broader community, sharing insights for improving hybrid work in software teams and taking social and human aspects of work from anywhere in software development.

KEYWORDS

Best practices, Hybrid work, Software development, Hybrid team management, Collaborative guide

ACM Reference Format:
Author 1, Author 2, Author 3, Author 4, and Author 5. 2024. Mastering Hybrid Work: A Practical Guide for Software Engineers. *ACM/IMS J. Data Sci.* 37, 4, Article 111 (August 2024), 10 pages. https://doi.org/XXXXXXX.XXXXXXX

Authors' addresses: Author 1, author1@email.com, University 1, City 1, City 1, Country 1; Author 2, author2@email.com, University 2, City 2, City 2, Country 2; Author 3, author3@email.com, University 3, City 3, City 3, Country 3; Author 4, author4@email.com, University 4, City 4, City 4, Country 4; Author 5, author5@email.com, University 5, City 5, City 5, Country 5.

ACM 2831-3194/2024/8-ART111
https://doi.org/XXXXXXX.XXXXXXX

1 INTRODUCTION

Software development teams are instrumental in driving the successful fruition of projects through collaborative efforts in the software development lifecycle [21]. Efficient teamwork and collaboration are important for ensuring project success, marked by high-quality deliverables, transparent communication, and effective coordination among team members [21].

Software development in the pre-pandemic era relied heavily on project management practices, agile methodologies, and a strong focus on quality to guarantee that software met all requirements. It minimized errors [10, 11, 15, 16]. As highlighted by de Souza Santos et al. [6], the COVID-19 pandemic led to the widespread adoption of hybrid work models, which improved work-life balance and flexibility for software professionals. However, this shift also reduced opportunities for spontaneous, informal interactions that are essential for team development, cohesion, and resilience [6].

Hybrid teams present a unique opportunity: combining on-site collaboration with access to a wider range of talent across geographical boundaries [10, 16]. However, these models also come with challenges in communication, work environment, and collaborative dynamics [10, 16].

This study explored best practices for hybrid software development teams through collaboration with a university and a major Brazilian multinational company. We employed a multifaceted approach, combining a comprehensive multivocal literature review, a case study utilizing semi-structured interviews and non-participatory observations, and a concluding focus group discussion. The previously published multivocal literature review and case study findings provided the foundation for the focus group, which is presented here. All stages involved 47 software development professionals across nine teams within the company. The resulting collaborative guide outlines 23 practices categorized across three core dimensions: individuals, processes, and spaces.

The research question (RQ) that guided this study was:

- RQ: *What are the practices for hybrid work in software teams?*

The guide was evaluated through focus group sessions involving participants, administrative staff, and the company's human resources (HR) team. These sessions corroborated that the recommendations have the potential to contribute to improving the hybrid work within the context of this specific organization, thereby improving communication, environment, and collaboration within these teams. The guide will also be disseminated to the external

community, particularly software engineering companies, to promote contributions to its continuous improvement.

This paper is organized as follows: Section 2 presents the theoretical underpinning, and Section 3 describes the research methodology used in this study. Section 4 presents our findings, Section 5 presents the discussion of the results, and in Section 6, we draw our conclusions.

2 BACKGROUND

This section explores the concept of teams and their crucial role in software development to lay the foundation for our study.

2.1 Software Development Teams

Software development teams comprise "knowledge workers" with high levels of education, specialized skills, and the ability to apply them to problem-solving [7, 8]. Since their work involves intangible cognitive processes, traditional manufacturing principles do not use [9].

Knowledge, especially tacit knowledge (implicit and experiential), resides in individual minds and forms the foundation of software development production. This necessitates tacit expertise coordination among team members [9].

Knowledge sharing becomes critical in software development [9]. Due to the often implicit nature of expert knowledge, acquiring and transmitting it are significant aspects of the development process. Agile methodologies, for example, rely heavily on the team's tacit knowledge rather than solely on written plans [22].

2.2 Human, Procedural, and Organizational Factors in SE

Software Engineering (SE) transcends mere software creation, encompassing human, procedural, and organizational factors essential for the effective development and maintenance of complex systems [3].

Interdisciplinary collaboration is crucial for software creation and maintenance, emphasizing the need for effective communication and team management [3]. Brooks [3] argues that the human aspect often dominates software project challenges, highlighting the importance of psychological and sociological factors over purely technical ones [14].

Well-structured processes outline software development practices and methodologies essential for product quality and efficiency [14], [21]. Humphrey [14] emphasizes the direct link between meticulous process management and improved quality and productivity in software development.

Team structuring and resource management are critical organizational aspects impacting software project success. Harter et al. [13] illustrate how evolved organizational practices lead to notable improvements in quality and efficiency [13].

2.3 Synergy of People, Processes, and Organizations

The synergy between people, processes, and organizations is essential for overcoming challenges and achieving excellence in software projects [3, 13, 21]. Despite the age of the cited references, they remain fundamental to understanding the core principles of SE. Recent research continues to explore and adapt these dimensions to new technological and methodological realities.

Therefore, this research used people [3], processes [21], and organizations [13] as a starting point during the discovery and initial proposal phases for the strategy of coding the impacts of COVID-19 on SE. These a priori categories transparently defined the scope of analysis. As described in the Artefact Availability section, this coding strategy was refined in the collaborative proposal, ultimately resulting in the final coding scheme: people, processes, and spaces.

2.4 Hybrid Software Development Teams

The COVID-19 pandemic acted as a large-scale, unplanned experiment in remote work, highlighting its potential for mutual benefits, according to Grzegorczyk et al., [12]. Their study suggests employers can offer flexible work arrangements without sacrificing productivity, while employees enjoy these arrangements as long as well-being remains a central focus [12]. With proper implementation, this increased demand and supply for flexible work can create a new economic equilibrium with improved employee well-being [12].

This shift towards flexible work models is particularly pronounced in software development. Fueled by the pandemic and corroborated by recent surveys by Smite et al., [25] and Zapata [28], a majority of software developers now express a preference for hybrid or fully remote work arrangements [25, 28]. Companies are adapting to this preference by offering long-term work-from-home (WFH) options, with some leading companies like Facebook, Square, Shopify, and Slack even implementing "work-from-anywhere" policies [26].

2.5 Defining Hybrid Software Development

As defined by Conboy et al., [5], hybrid software development involves teams with members working remotely, in the office, or a combination of both settings [5]. This creates a work environment that is neither fully distributed nor entirely co-located, with team members likely having some flexibility in choosing their work location [5]. This shift necessitates transitioning from traditional team structures towards models that can effectively manage geographically dispersed teams [19].

3 RESEARCH METHOD

This section outlines the research design, data collection methods, and analysis techniques used to investigate: what are the practices for hybrid work in software teams?

3.1 Background and justification

This study adopts an exploratory approach to understanding the impact of COVID-19 on working models in software engineering (SE). According to Yan [27], an interpretivist epistemology allows for a broader construction of meaning. A mixed methods approach utilizes both quantitative and qualitative data, prioritizing qualitative data for in-depth exploration complemented by quantitative insights [27]. The research design is cross-sectional, capturing a snapshot of the current state [27]. This research employs a combination of methods: Multivocal Literature Review, Case Study, and

Focus Group. As illustrated in Figure 1, the research methodology employed in this study is depicted.

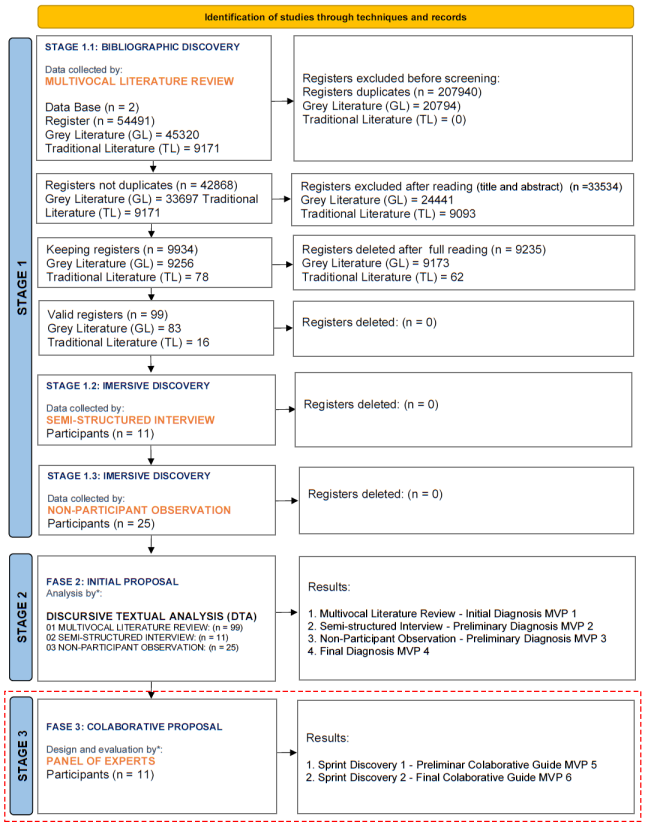

Figure 1: Detailed flow of the research methodology

Each research stage began with a kick-off meeting [23] to contextualize the research and align expectations. Member check [4] meetings ensured participant perspectives were incorporated throughout the research. These meetings involved the company's administrative team [2], comprising the sponsor, product owner (PO), and human resources manager. This team's consistent involvement maintained the research focus and ensured alignment with the planned scope.

By incorporating these milestones as collaborative activities, the research benefited from:

- Guided methodological path: continuous check-ins helped refine the chosen methods;
- Validation and refinement of results: active participant feedback allowed for ongoing validation and refinement of findings;
- Minimized researcher bias: collaborative review processes minimized bias through participant feedback.

This collaborative approach fostered a collective intelligence format, where the results emerged from a shared construction of knowledge rather than a singular researcher's perspective.

3.1.1 Stage 1 - Discovery. The first research stage involved a two-pronged approach: bibliographic discovery and immersive discovery. The bibliographic discovery utilized a Multivocal Literature Review (MLR) to map the existing research on the impact of COVID-19 on Software Engineering (SE). This was followed by an immersive discovery stage using a Case Study (CE) to explore the unique day-to-day experiences within a specific company. The data collected in this stage fed into the next stage, the initial proposal development.

3.1.2 Stage 2 - Initial Proposal. The second stage focused on synthesizing results from the bibliographic and immersive discovery stages. This involved developing initial, preliminary, and final diagnoses as an artifact. These diagnoses captured the key impacts of COVID-19 on SE teams, both externally evidenced through the literature review and internally observed through the case study.

3.1.3 Stage 3 - Collaborative Proposal. Our study utilizes an expert advisory group approach to evaluate the proposed method for facilitating a hybrid working model in software engineering. An expert advisory group is an investigative technique that identifies the strengths and weaknesses of a specific process, approach, model, practice, or technique [1]. The group comprises professionals with recognized expertise in areas relevant to the study. Their insights are crucial for developing and validating models or frameworks [1].

According to Beecham et al., [1] leveraging experts is a valuable technique for identifying and preventing potential failures. Their experience allows them to offer pertinent advice by assessing the merits and shortcomings of the proposed approach. While differences in opinion may arise, consensus-based conclusions and recommendations are typically reached [1].

This research employed an expert advisory group to examine the initial proposal for facilitating good practices within the hybrid working model for the software engineers at the company under investigation. The group's role was to synthesize best practices based on their expertise.

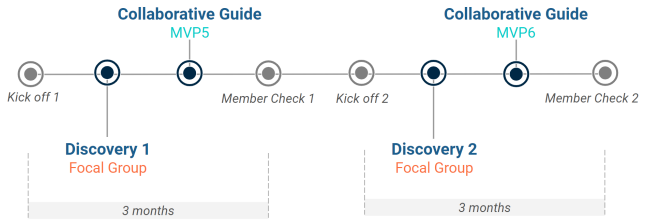

Figure 2: Approach design stage 3

Stage 3, as illustrated in Figure 2, utilizes a two-*sprint* iterative approach. Each *sprint* follows a structured workflow:

(1) Kick-off Meeting: Establishes the sprint goals and aligns participants.
(2) Discovery Stage: Conducts activities to gather and analyze data.
(3) Member Check Meeting: Validates findings and gathers feedback from participants.

This methodology mirrors the principles of a *Scrum process*, leveraging familiar concepts from software development: *Design Thinking* for problem-solving, *Lean* for iterative learning, and *Agile* for

adapting to change [24]. Therefore, stage 3 does not employ semi-structured interviews. Instead, it fosters a collective intelligence process, transforming the initial proposal into a collaboratively refined solution akin to open innovation practices [17].

Software developers from the company were selected to participate in the study based on pre-defined criteria [X]. The company's Human Resources (HR) team conducted the recruitment process following the company's internal policies. The specific focus group protocol used for recruitment is included as an additional artifact in this article.

3.2 Focal Group Protocol

The specific focus group protocol used for participant recruitment is available online in a public repository. The protocol link is also included in the Artefact Availability section of this paper for ease of reference.

3.3 Data Collection and Analysis Strategy

This research employed an open focus group format, avoiding a structured interview approach. Due to the COVID-19 pandemic, the focus group was conducted remotely, necessitating adjustments to the configuration (location, arrangement, equipment) and materials (digital-focused). To facilitate discussion in this remote environment, the following strategies were implemented:

(1) Challenge or Initial Proposal: the session commenced by presenting a challenge, problem, or proposal as a starting point for discussion. This could be presented verbally, through video, a reading, or any engaging and thought-provoking material;
(2) Safe Open Discussion Environment: participants were encouraged to share their ideas, experiences, and perspectives on the presented topic. The moderator acted as a facilitator, guiding the conversation subtly and ensuring equal participation. However, a rigid question structure was avoided;
(3) Facilitation Techniques: the moderator actively promoted interaction through techniques such as encouraging participants to comment on each other's ideas, periodically summarizing discussions to maintain focus, Dividing the group into subgroups to explore different aspects of the topic;
(4) Documentation and Analysis: discussions were meticulously documented using recordings, detailed notes, or even visual methods like mind maps or collaborative dashboards. The analysis focused on identifying emerging patterns, innovative ideas, and significant consensus or divergence using qualitative and interpretive methods;
(5) Ethical Considerations: ethical considerations remained paramount throughout the process. Informed consent, privacy, and confidentiality of participants were guaranteed. Improvements:

3.4 Focal Group Participants

Table 1 shows that the profile of the focus group participants reflects both the diversity of skills and geographical distribution. The participants are identified both by gender, with a representation of men (M) and women (F), and by their different roles in the organization, ranging from developers to team leaders and high-level managers, such as Directors and HR Managers. Professional experience among the members ranges from 6 to 23 years, showing a combination of youthful vigor and seasoned wisdom. With multiple participants based in Rio de Janeiro, and others spread across cities such as Rio Grande do Sul and Florianópolis. Details of the participants are provided in Table 1, including: Participant Name (Anonymized) (PN); Participant's Team (PT); Participant's Gender (Self-Declared): F (Female) or M (Male) (PG); Participant's Role or Function within the Company (FUN)'Participant's Professional Experience (in Years) (PPE); Participant Location (LOC); Previous Professional Experience with Distributed Software Development (PRE) and Admitted to the Company During the Pandemic (Yes/No) (ADM).

Table 1: Stage 3 - Participants

PN	PT	PG	FUN	PPE	LOC	PRE	ADM
P01	A	F	Product Owner (PO)	23	Rio de Janeiro	Yes	Yes
P02	A	M	UX Developer.	14	Rio de Janeiro	Yes	Yes
P03	A	M	Developer	15	São Paulo	Yes	Yes
P04	B	F	Manager	30	Rio Grande do Sul	No	No
P05	C	M	Coordinator	12	Rio de Janeiro	Yes	No
P06	D	M	Product Owner (PO)	20	São Paulo	Yes	Yes
P07	E	M	Developer	08	Rio Grande do Sul	Yes	Yes
P08	F	M	Specialist	08	São Paulo	No	No
Q09	E	M	UX Developer.	06	Maranhão	No	Yes
P10	G	F	HR Manager	22	Rio de Janeiro	Yes	No
P11	H	M	Director.	20	Rio de Janeiro	Yes	No

Caption: NDP means participant name; TDP means participant time; GDP participant gender: self-declared by (F = female and M = male); PDP is the role or function you perform in the company; EDP: experience of the participant's professional (in years); EPDSS: previous professional experience with distributed software development; ADP: indicates admission to the company during the pandemic.

In relation to adaptability and previous experience with project management methodologies, the team presents a division between those with and without experience in distributed projects, indicating an environment where the exchange of knowledge and practices can occur. Table 1 also reveals that some members were admitted during the pandemic. This factor can also signal a team's predisposition towards flexibility and innovation in work practices, especially with regard to hybrid work. The company start dates show participants joining the company at different times, varying between those who joined the company during the pandemic (6) and before the pandemic (5).

The project team exhibits diversity in project management experience and adaptability, particularly regarding distributed projects. This is evident in the presence of members with and without experience in such projects, suggesting an environment conducive to knowledge and practice exchange (Table 1). Furthermore, the table reveals that some team members were hired during the pandemic. This factor might also indicate a team predisposition towards flexible and innovative work practices, particularly regarding hybrid work models. The varying start dates within the company further highlight this potential for adaptation, with members joining both before (5) and during (6) the pandemic.

3.5 Limitations to Validity

This research employed an open focus group format due to its value in exploratory studies. Open focus groups are ideal for generating new ideas, gaining an in-depth understanding of participant perspectives, and exploring under-researched areas, all of which were central to this research. The challenge, however, lies in ensuring focused discussions and promoting inclusivity even within a less structured format.

Since the participant diaries were not recorded, textual analysis techniques were not feasible. To overcome this limitation, the following strategies were implemented:

- Field Diaries: Researchers maintained field diaries to document each focus group session.
- Slack Channel: A dedicated Slack channel was created to facilitate continuous results sharing. Following each session, a summary of the discussions was posted on the channel, including participants (from both the company and university), critical alignments made, and action items ("to do").

This approach promoted focus and alignment throughout the research phase. The field diaries were a permanent session record, while the Slack channel facilitated ongoing communication and knowledge sharing.

4 RESULTS

This research aimed to answer the question: *What are the practices for hybrid work in software teams?* To achieve this, we conducted two three-month discovery sprints.

4.1 Focus Group Input and Artifact Design

Following a focus group discussion, participants agreed to develop an artifact as a minimum viable product (MVP) iteratively developed throughout each discovery *sprint*. This approach aimed to share lessons learned with the community.

During artifact creation, we utilized various tools: spreadsheets, Data compilation, Teams: online agenda management, Slack: asynchronous communication, Midjourney: visual identity image generation, Figma: design of MVP6, Google Presentations: summarizing MVP5 and MVP6, and Data Recording and Communication.

While the collaborative proposal protocol allowed for meeting recordings, the company-organized meetings were not recorded. Therefore, researchers documented the sessions in field diary format.

The dedicated Slack channel facilitated asynchronous communication and continuous result sharing. Following each session, researchers posted a summary on the channel. This summary includes all discussion points, a List of participants (company and university). Critical alignments were made, as well as action items ("to do"); this strategy ensured focus and alignment throughout the collaborative stage. Additionally, at least two researchers participated in each meeting to minimize potential researcher bias.

4.2 Results and Comparison

Table 2 depicts the initial proposal compared to the collaborative proposal. The primary difference lies in the organization of the architecture and narrative for the lessons learned and the progress made toward developing good practice recommendations for each topic. We present the detailed results in the following section.

4.3 Collaborative Proposal: Discovery 1 - MVP5

4.3.1 Sprint Discovery 1. This section details the activities conducted during Discovery 1, which focused on developing Minimum Viable Product version 5 (MVP5) for the collaborative proposal.

Weeks 1-2: Establish Alignment and Onboarding: Discovery 1 began with an open seminar. We onboarded participants by presenting the research background and the results from the initial proposal (informed by "stage 1: discovery" and "stage 2: initial proposal") and establishing expectations for "stage 3: collaborative proposal." This alignment was crucial to clarify the purpose of refining the initial proposal through collaboration with company experts.

Weeks 3-4: Validate and Refine Content (MVP5): We initiated the development of MVP5 content by validating participants' perceptions of the initial proposal's three axes (person, process, and organization) and twelve topics. Participants agreed that these elements were sufficient for the collaborative proposal. Participants emphasized the importance of avoiding a prescriptive approach, stating, "This is not a rule book!". In their view, the guide should foster open communication and clarification regarding hybrid work challenges in software development. Additionally, participants did not prioritize any specific axis or topic. The group then discussed each axis separately, starting with people, followed by processes, and finally, organizations. We reviewed topic concepts for each axis and rewrote recommendations based on the findings of the initial proposal. We presented three good practice guides identified in non-academic literature as references and examples for the participating experts.

Weeks 5-6: Prototype and Refine Design: The content for "Opening the Future of Work: A Collaborative Guide to the Hybrid Model for Software Engineering" (Collaborative Guide—MVP5) took shape within an initial proposal for the content architecture, narrative flow, and visual identity (using images generated by Midjourney). We created a presentation using Google Cloud tools to share the MVP5 results. Here, we identified an opportunity to collaborate with the company's UX team to refine the artifact's visual identity aFEr validating MVP5's initial content structure.

Weeks 7-8: Finalize and Validate MVP5: Discovery 1 concluded with member check meetings involving research managers and the human resources team from the company. These meetings aimed to validate the results and finalize the Collaborative Guide - MVP5. This stage was completed by the end of April 2023. Figure **??** summarizes the architecture and narrative of the collaboratively developed content proposed by the expert panel.

The Table 2 shows the highlights of MVP5. In this version the participants validated the initial proposal's three axes (person, process, and organization); improved topics and recommendations: topics were refined, and recommendations for good practices were a ded. These recommendations were built upon the initial proposal's findings (informed by MLR) and optimized based on the expert focus group's insights. The recommended practices in MVP5 encompass a wide range, including time management. Practices like "Setting periods in the agenda for meetings between people

Table 2: Collaborative Proposal MVP5

COD	RECOMMENDATIONS
R01	Set periods in the agenda for meetings between people and teams.
R02	Set closed periods in the agenda for uninterrupted work.
R03	Open the cameras in online meetings whenever possible.
R04	Hold 1:1 meetings to get to know people and teams.
R05	Actively participate in meetings, either orally or in writing.
R06	Periodically follow up with new employees at the beginning.
R07	Plan part of the onboarding in one of the company's physical offices.
R08	Promote training sessions at one of the company's physical offices.
R09	Encourage employee participation in external face-to-face events.
R10	Allow a flexible hybrid model, taking into account individual and organizational context
R11	Create office environments aligned with the demands of hybrid performance.
R12	Create virtual environments for hybrid agendas.
R13	Encourage pairing between people and teams.
R14	Encourage a culture of collaborative practices on a permanent basis.
R15	Prioritize the development of creative actions in face-to-face agendas.
R16	Encourage 1:1 feedback from participants in hybrid agendas.
R17	Transparent and assertive communication of the corporate vision and culture regarding the hybrid model.
R18	Transparent and assertive communication about the policies adopted for the hybrid model.
R19	Promote climate monitoring actions with employees.
R20	Encourage company integration events.
R21	Map existing infrastructure conditions for hybrid work.
R22	Provide the right infrastructure for hybrid work.
R23	Define a transparent and assertive policy on the use, ergonomics, and maintenance of the infrastructure provided.
R24	Permanently monitor employee infrastructure.

and teams (R01)" were introduced; infrastructure support: measures such as "Providing the infrastructure for efficient hybrid working" (R23) were addressed; the focus on fostering continuous personal development and ensuring permanent psychological safety reflects a commitment to employee well-being and growth.

Table 2 suggests that a successful transition to flexible work models requires more than just adjustments to work policies and practices. Investment in organizational culture, effective communication, and adequate infrastructure are also necessary. These findings complement existing research on the pandemic's impact on Brazilian software engineering, as discussed by Oliveira et al., [18].

4.4 Collaborative Proposal: Discovery 2 - MVP6

4.4.1 Sprint Discovery 2. This section details the activities conducted during Discovery 2, which focused on refining Minimum Viable Product version 6 (MVP6) for the collaborative proposal.

Weeks 9-10: Refining Content and Scope: Discovery 2 began by addressing suggestions from the UX participant. We consolidated ten topics into nine, merging "Agile methods - Ceremonies" and "Agile methods - pairing" into "Definition and implementation of permanent collaborative practices." Time constraints prevented further exploration of codifying recommendations based on the hybrid model spectrum (office-first, flexible, remote-first). The group also discussed the possibility of creating a manifesto with signatories from all research stages. However, this required additional company policy approvals and fell outside the initial research scope. Therefore, a manifesto was not included in the final proposal.

Weeks 11-12: Content Development and Iteratio: During MVP6 development, the expert group suggested renaming the "Organizations" axis to "Spaces." Additionally, topics were reorganized within the "Processes" axis to address both technical and corporate processes. Based on the group's feedback, a new recommendation, "P16 Prioritize alignments of strategy and goals in face-to-face agendas," was added. Each axis received contextualizing text for clarity. The possibility of hosting the artifact online via the company's GitHub for continuous access and collaboration was explored. However, concerns regarding update management and feedback collection formats limited progress due to potential resource constraints on the company's side, as this fell outside their project scope. The final version of MVP6 is presented in Table 3.

Weeks 13-14: Usability and Visual Identity Refinement: This period focused on content validation and preparation for usability and visual identity improvements by the company's UX team. The collaborative MVP6 proposal (Table 3) was redesigned using Figma, resulting in a version optimized for potential future online publication as a webpage. The UX team introduced visual coding using tags to indicate the target audience for each recommendation. It identified each recommendation's primary target audience ("WHO"): "For the employee" (E), "For the manager" (M), "For the company" (C), and "For all" (A).

Weeks 15-16: Finalization and Validation: Following revisions and improvements, Discovery 2 concluded by validating the final Collaborative Proposal - MVP6. The proposal achieved a more business-oriented communication style while adhering to usability standards and the company's visual identity policy. Research managers and human resources representatives approved this new version. This stage was completed in October 2023.

Table 3 summarizes the results of the collaborative proposal for Minimum Viable Product (MVP) version 6. The table presents the recommended practices, categorized by axes: People (codes 1-8), Process (codes 9-17), and Spaces (codes 18-23). It also identifies each recommendation's primary target audience ("WHO"). This revised proposal shows significant improvements compared to the initial proposal (Table 2). These advancements encompass the proposal's architecture, content narrative, presentation style, technical usability, and alignment with the company's visual identity. Due to confidentiality restrictions, specifics regarding these improvements cannot be disclosed at this time but maybe revealed upon acceptance of this submission. W5

Table 4 presents critical recommendations for establishing a hybrid work model, informed by a comparative analysis of the results of our study and Google [10], Phygital [20], and Microsoft's [16] Hybrid Work Practice Guides.

The analysis identified a few recurring themes that contribute to a hybrid environment:

- Active Participation (R02): Encourage active participation in meetings, verbally and through written contributions, regardless of physical location (adopted by all three guides). This fosters a sense of inclusion and ensures everyone has an opportunity to be heard.

Table 3: Collaborative Proposal MVP6

COD	RECOMMENDATIONS	WHO
R01	Set aside some periods in your schedule to hold meetings and others to work without interruption.	E
R02	Take an active part in meetings, either orally or in writing	E
R03	Open the camera in online meetings whenever possible	E
R04	Hold 1:1 meetings to get to know people and teams	E
R05	Follow up regularly with new employees	M
R06	Plan part of the onboarding of new employees in an office	M
R07	Promote training sessions in one of the company's physical offices	M
R08	Encourage employees to attend conferences, training sessions, and external face-to-face lectures	M
R09	Allow for a flexible hybrid model taking into account individual and organizational contexts	C
R10	Encourage pairing between people of different seniorities	M
R11	Encourage a culture of collaborative practices on a permanent basis	A
R12	Prioritize the development of creative actions in face-to-face agendas	A
R13	Make sure that in hybrid agendas, remote participants are heard as much as those meeting in person	M
R14	Encourage company integration events	M
R15	Prioritize the alignment of strategy and goals in face-to-face agendas	M
R16	Talk transparently about the organizational culture and the policies of the work model adopted	A
R17	Promote actions to monitor the organizational climate with employees	M
R18	Create an office environment aligned with the demands of hybrid performance	C
R19	Create virtual environments for hybrid agendas (think of tools or metaverses)	C
R20	Map the existing infrastructure conditions for hybrid work	M
R21	Provide the infrastructure for adequate hybrid working	C
R22	Define a transparent and assertive policy for the use, ergonomics, and maintenance of the infrastructure provided	C
R23	Permanently monitor the employee's infrastructure	M

- Onboarding and Support (R05): Microsoft [16] emphasizes the importance of regular follow-up with new employees, especially in a hybrid setup. This can be achieved through virtual check-ins, mentorship programs, and readily available resources for acclimation.
- Centralized Training (R07): All three guides recommend offering training sessions within a physical office location. This fosters team building and provides a dedicated space for focused learning. Additionally, consider offering virtual training options for accessibility.
- Flexible Hybrid Model (R09): Microsoft highlights the importance of a flexible hybrid model that considers individual needs and organizational contexts. This allows for a customized approach that prioritizes employee well-being while meeting business objectives.
- Culture of Collaboration (R11): Both Google [10], and Phygital [20] emphasize fostering a culture of collaboration permanently. This includes establishing clear communication protocols, utilizing collaborative tools, and encouraging knowledge sharing across physical and virtual boundaries.
- Transparency and Communication (R16): Openly discuss the adopted organizational culture and the policies governing the hybrid work model (practices advocated by Phygital and Microsoft). This transparency builds trust and ensures everyone is on the same page.
- Monitoring and Feedback (R17): All three companies recommend implementing processes to monitor the organizational climate with employee involvement. This allows for course correction and continuous improvement of the hybrid work model.
- Virtual Environments (R19): Explore the creation of virtual environments designed explicitly for hybrid work agendas, potentially utilizing metaverse technologies (a concept mentioned by both Phygital and Microsoft). These virtual environments can facilitate collaboration and team building and enhance the hybrid work experience.

Table 4: Comparative evaluation

COD	Google	Phygital	Microsoft
R01			
R02	X	X	X
R03			X
R04			X
R05			X
R06			X
R07	X	X	X
R08			X
R09			X
R10			X
R11	X	X	
R12			X
R13			X
R14			X
R15			X
R16		X	X
R17	X	X	X
R18			X
R19		X	X
R20			X
R21			X
R22			X
R23			X

Table 5 presents the evidences identified by Google [10], Phygital [20], and Microsoft's [16] Hybrid Work Practice Guides.

Looking comparatively from the Table 5, we see a comparison between the practices recommended in the MVP6 guide and those implemented by companies such as Google [10], Microsoft and Phygital, Phygital [20], and Microsoft's [16], according to the recommendations divided into the three main categories: people, processes and spaces.

With regard to the 'people' category, MVP6 emphasizes the importance of clear communication and the establishment of partnerships between employees at different levels of seniority. Best practices seek to improve the onboarding of new team members and foster a culture of continuous collaboration. Comparison with benchmarks shows that while MVP6 recommends practices such as holding online meetings with open cameras and assigning a

Table 5: Comparative evidences

	Evidences	Guide
R01	Improve onboarding for new team members	Google
R03	When you are on camera, you can convey to team members who are speaking that they have your full attention by having your whole upper body visible	Microsoft
R04	A Phygital work environment promotes the value of the uniqueness of the person	Phygital
R04	Line up meetings that are particularly well-suited for face-to-face interactions, like team building and bonding events and creative brainstorms	Microsoft
R05	Make sure all new hires have an onboarding buddy	Microsoft
R06	Hybrid collaboration is fast-moving and fluid	Google
R09	Building a hybrid work culture: Establishing best practices that promote a "hybrid first" mindset	Google
R09	A Phygital work environment is agile and integrates online and offline dimensions of work	Phygital
R09	Build in-person rituals that connect people and teams—a weekly taco lunch, an annual concert	Microsoft
R12	Hybrid brainstorming is increasingly useful, but the classic free-form whiteboarding session benefits from the immediacy of being together in a person	Microsoft
R14	In a truly connected organization, people can communicate effectively no matter where they are—and no matter when they work	Microsoft
R15	A Phygital work environment is a sharing environment that promotes a sense of belonging	Phygital
R15	Build in-person rituals that connect people and teams—a weekly taco lunch, an annual concert	Microsoft
R16	A Phygital work environment is distinguished by a widespread sense of responsibility	Phygital
R16	Codify the New Norms and Best Practices —and Revisit Them as You Learn More	
R17	A Phygital work environment is pleasant to live in	Phygital
R20	Designated space managers can share company-wide news and updates — everything from annual reports to company celebrations — in broadcast-only spaces to ensure important messages are reaching teams, with replies limited or disabled	Google

colleague to help with the onboarding of new hires, companies such as Google [10] and Microsoft [16] also adopt similar strategies, but with additional ones, such as building face-to-face rituals and promoting a "hybrid first" mentality. This alignment suggests that MVP6 is in line with the practices of leading companies, reinforcing its relevance for software engineers working in hybrid environments.

In the 'processes' category, MVP6 and the benchmark practices demonstrate a shared vision of the importance of agility and the integration of the online and offline dimensions of work. MVP6 places a special focus on collaborative practices, such as hybrid brainstorming and the promotion of effective communication, regardless of location. Microsoft [16] and the Phygital [20] concept stand out for emphasizing shared environment and shared responsibility, which is not explicitly mentioned in MVP6. This may indicate an area of further development for our guide, seeking to incorporate a greater emphasis on responsibility and knowledge sharing as pillars of hybrid working.

As for the 'spaces' category, MVP6 offers pragmatic recommendations for creating work environments and infrastructures that support hybrid work, which is corroborated by the practices of the companies analyzed. The importance of well-designed spaces for hybrid meetings and adequate infrastructure for remote workers is a common theme. However, Google's [10] guide seems to go further by suggesting that designated space managers share company news and updates in broadcast spaces, a practice not addressed by MVP6. This recommendation could be an important differentiator, suggesting that MVP6 could benefit from including practices that foster effective and engaging corporate communication in a hybrid context.

In summary, the MVP6 provides a solid set of recommendations that mirror and complement practices from tech giants and hybrid working innovations. Its orientation to the human, operational and physical aspects of hybrid work covers most of the essential areas. However, to further enhance our guide, it would be beneficial to consider integrating additional practices observed in the benchmarking, such as shared responsibility, face-to-face rituals that strengthen company culture, and innovative corporate communication strategies. These additions would help ensure that software engineers are well equipped to navigate the complexities of the modern hybrid workplace.

5 DISCUSSION

Discovery Sprints 1 and 2 played a pivotal role in refining the collaborative proposal for good practices in hybrid software development. This iterative process yielded valuable insights and improvements across several dimensions.

5.1 Content and Structure Validation

Participant feedback during Discovery 1 (MVP5) validated the initial proposal's core structure, which has three axes (person, process, organization) and 12 topics.They emphasized the importance of clear communication, avoiding a prescriptive approach, and ensuring the guide is a resource for navigating challenges, not a set of rigid rules. Discussions within the focus group facilitated the refinement of topic content and the addition of recommendations based on their experience.

5.2 Usability and Visual Identity

Discovery 2 (MVP6) focused on enhancing the proposal's usability and visual identity to align with industry standards and the company's branding. Using Figma, collaboration with the company's UX team improved information architecture, content clarity, and

user experience design. The introduction of visual coding with audience tags (e.g., "For the employee") further enhanced usability by clearly targeting recommendations to specific user groups.

5.3 Key Considerations and Future Work

The exploration of codifying recommendations based on the hybrid work model spectrum (office-first, flexible, remote-first) proved valuable but was ultimately limited by time constraints. This remains an area for potential future research.

The proposal's scope did not encompass the creation of a formal manifesto due to resource limitations and the need for additional company policy approvals. However, the discussions around this concept highlight the potential for future work on establishing a broader set of principles for hybrid work within the company. Hosting the final guide online via the company's GitHub for ongoing community access and collaboration was considered but posed challenges related to update management and resource allocation. Further exploration of suitable online platforms or knowledge-sharing mechanisms is warranted.

Overall, the iterative approach employed through Discovery Sprints 1 and 2 effectively addressed the initial proposal's strengths and weaknesses. The resulting collaborative good practice guide is better equipped to support the company's transition to a hybrid work model. It can serve as a valuable resource for future research in this domain.

6 CONCLUSION

The COVID-19 pandemic has fundamentally reshaped the software engineering landscape, necessitating the widespread adoption of hybrid work models. While offering flexibility, these models present communication, collaboration, and cultural preservation challenges. This paper addresses these challenges by introducing a collaborative proposal for good practices in hybrid software development.

Developed through an iterative process involving Discovery Sprints 1 and 2, the proposal leverages expert insights to refine the initial content and structure. Discovery Sprint 1 focused on validating the core framework and content (MVP 1), emphasizing clear communication, fostering a collaborative environment, and psychological safety. Discovery Sprint 2 then enhanced usability and visual identity (MVP 6) by collaborating with the company's UX team for improved information architecture, user experience design, and audience-specific recommendations.

The resulting collaborative proposal offers a comprehensive guide for organizations transitioning to hybrid work models. Key areas of focus include:

- Building a culture of psychological safety and clear communication.
- Promoting inclusive practices for onboarding and fostering continuous development.
- Adapting processes to accommodate different work environments.
- Balancing autonomy with effective collaboration to achieve team goals.
- Optimizing physical and digital spaces to support hybrid work effectively.
- Prioritizing employee well-being and mental health.

This research demonstrates the effectiveness of iterative development in refining a collaborative good practices guide. The proposed framework provides a valuable resource for organizations seeking to navigate the complexities of hybrid software development and ensure their teams' continued efficiency, well-being, and innovation in the post-pandemic era.

ARTEFACT AVAILABILITY

Below is a link with shared artifacts:
https://github.com/covid19impactse/sbes2024

REFERENCES

[1] Sarah Beecham, Tracy Hall, Carol Britton, Michaela Cottee, and Austen Rainer. 2005. Using an expert panel to validate a requirements process improvement model. *J. Syst. Softw.* 76, 3 (jun 2005), 251–275. https://doi.org/10.1016/j.jss.2004.06.004

[2] R Meredith Belbin. 2010. *Management teams.* Routledge.

[3] Frederick P. Brooks Jr. 1975. *The Mythical Man-Month: Essays on Software Engineering.* Addison-Wesley.

[4] Julie A Carlson. 2010. Avoiding traps in member checking. *Qualitative Report* 15, 5 (2010), 1102–1113.

[5] Kieran Conboy, Nils Brede Moe, Viktoria Stray, and Jan Henrik Gundelsby. 2023. The future of hybrid software development: challenging current assumptions. *IEEE Software* 40, 02 (2023), 26–33.

[6] Ronnie de Souza Santos, Gianisa Adisaputri, and Paul Ralph. 2023. Post-pandemic Resilience of Hybrid Software Teams. In *2023 IEEE/ACM 16th International Conference on Cooperative and Human Aspects of Software Engineering (CHASE).* IEEE, 1–12.

[7] Tom DeMarco and Tim Lister. 2013. *Peopleware: productive projects and teams.* Addison-Wesley.

[8] Peter Drucker. 2012. *Post-capitalist society.* Routledge.

[9] Samer Faraj and Lee Sproull. 2000. Coordinating expertise in software development teams. *Management science* 46, 12 (2000), 1554–1568.

[10] Google. 2022. Navigating hybrid work: a Google Workspace handbook. https://inthecloud.withgoogle.com/navigating-work-handbook/dl-cd.html

[11] Google. 2022. O futuro do trabalho no Brasil:Insights sobre a colaboração e novas formas de trabalho. https://inthecloud.withgoogle.com/the-future-of-work-ptbr/download.html

[12] Monika Grzegorczyk, Mario Mariniello, Laura Nurski, and Tom Schraepen. 2021. *Blending the physical and virtual: a hybrid model for the future of work.* Technical Report. Bruegel Policy Contribution.

[13] D. E. Harter, M. S. Krishnan, and S. A. Slaughter. 2000. Effects of Process Maturity on Quality, Cycle Time, and Effort in Software Product Development. *Management Science* 46, 4 (2000), 451–466.

[14] Watts S. Humphrey. 1989. *Managing the Software Process.* Addison-Wesley Longman Publishing Co., Inc.

[15] Microsoft. 2021. The New Future of Work:Research from Microsoft into the Pandemic's Impact on Work Practices. https://www.microsoft.com/en-us/research/uploads/prod/2021/01/NewFutureOfWorkReport.pdf

[16] Microsoft. 2022. The WorkLab Guides: How to Hybrid. https://www.microsoft.com/en-us/worklab/hybrid-work-guides

[17] Nesta. 2019. Collective Intelligence Design Playbook (beta). https://www.nesta.org.uk/toolkit/collective-intelligence-design-playbook/

[18] Edson Oliveira, Gislaine Leal, Marco Túlio Valente, Marcelo Morandini, Rafael Prikladnicki, Leandro Pompermaier, Rafael Chanin, Clara Caldeira, Letícia Machado, and Cleidson de Souza. 2020. Surveying the Impacts of COVID-19 on the Perceived Productivity of Brazilian Software Developers. In *Proceedings of the 34th Brazilian Symposium on Software Engineering* (Natal, Brazil) *(SBES '20).* Association for Computing Machinery, New York, NY, USA, 586–595. https://doi.org/10.1145/3422392.3422444

[19] Ipek Ozkaya. 2021. The future of software engineering work. *IEEE Software* 38, 05 (2021), 3–6.

[20] Phygital. 2021. Phygital Work Manifesto. https://f.hubspotusercontent30.net/hubfs/5264884/01_Phygital%20Work%20Manifesto/IAA_phygital_manifesto_rev2.pdf

[21] Roger S Pressman. 2005. *Software engineering: a practitioner's approach.* Palgrave macmillan.

[22] Sharon Ryan and Rory V O'Connor. 2009. Development of a team measure for tacit knowledge in software development teams. *Journal of Systems and Software* 82, 2 (2009), 229–240.

[23] Jochen Schmitt, S Deckert, M Alam, C Apfelbacher, J Barbaric, A Bauer, J Chalmers, O Chosidow, F Delamere, E Doney, et al. 2016. Report from the kick-off

meeting of the Cochrane Skin Group Core Outcome Set Initiative (CSG-COUSIN). *British Journal of Dermatology* 174, 2 (2016), 287–295.

[24] J. Schneider and an O'Reilly Media Company Safari. 2017. *Understanding Design Thinking, Lean, and Agile*. O'Reilly Media, Incorporated. https://books.google.com.br/books?id=UPfKtAEACAAJ

[25] Darja Smite, Anastasiia Tkalich, Nils Brede Moe, Efi Papatheocharous, Eriks Klotins, and Marte Pettersen Buvik. 2022. Changes in perceived productivity of software engineers during COVID-19 pandemic: The voice of evidence. *Journal of Systems and Software* 186 (2022), 111197.

[26] Kristin Stoller. 2021. Never want to go back to the office? Here's where you should work. *Forbes, available at: www. forbes. com/sites/kristinstoller/2021/01/31/never-want-to-go-back-to-the-office-heres-whereyou-should-work/(accessed 29 September 2022)* (2021).

[27] R.K. Yin. 2001. *Estudo de caso: planejamento e métodos*. Bookman. https://books.google.com.br/books?id=bQXKAAAACAAJ

[28] Laura Zapata, Gerardo Ibarra, and Pierre-Henri Blancher. 2024. Engaging new ways of work: The relevance of flexibility and digital tools in a post-COVID-19 era. *Journal of Organizational Effectiveness: People and Performance* 11, 1 (2024), 1–17.