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Cracks in the Foundation: How Relational Communication Dynamics Predict Performance Improvement in Cross-Functional Teams

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ABSTRACT

Cross-functional teams are vital decision-making units in supply chain management, and scholars emphasize the need to understand how team processes shape performance improvement. Despite promising research on communication within cross-functional teams, scant attention has been paid to real-time communication patterns—integral to behavioral supply chain management—which are fundamental to team processes in practice. This article posits, drawing on interaction ritual theory, that early communication patterns are correlated with the performance trajectories of cross-functional teams, suggesting a potential influence. The authors tested this idea in a complex supply chain management simulation featuring cross-functional teams. They employed a novel coding approach to capture temporal interactions, which yielded 25,641 coded verbal behaviors from cross-functional team meeting interactions. To identify systematic communication patterns, lag sequential analysis was performed on this corpus of data. The results show that the frequency of relational communication was associated with weaker performance improvement in cross-functional teams across six simulation iterations. Even more interestingly, when relational communication was frequently followed by task-oriented communication, no association with team performance improvement was observed. Further, cross-functional teams in which relational communication was more frequently followed by counterproductive communication showed notably weaker performance improvements. Focusing on interactional flow within team dynamics, this research challenges the common belief regarding the value of broadly evaluating cross-functional teams. As such, it advocates for adopting both a behavioral and a temporal lens to uncover how cross-functional teams can prevent detrimental interactions in their daily operations.

Jiachun Lu was added as a co-author in the process of developing this paper, in recognition of her expertise in supply chain management and her significant contributions to the writing. She played a key role in rewriting the manuscript, revising it in response to feedback, and conducting qualitative follow-up interviews to contextualize and situate our quantitative findings. Michaéla Schippers is included as a co-author in recognition of her contribution to the initial conceptualization of the study. She was not actively involved in the data collection, analysis, or writing of this manuscript.

1 | Introduction

Cross-functional teams—groups drawn from different departments—are crucial in supply chain operations, yet they often face challenges that undermine their effectiveness. The diverse knowledge base of cross-functional team members helps navigate challenging situations, such as supply chain disruptions or supplier selection (Kaufmann, Wagner, and Carter 2017; van den Adel, de Vries, and van Donk 2022). At the same time, cross-functional teams often face major challenges due to different perspectives and perceived dissimilarities among team members (Lonsdale, Sanderson, and Esfahbodi 2024). These challenges can hinder cross-functional integration and organizational performance (Mehta and Mehta 2018). Recognizing the critical role of team processes and dynamics, scholars have begun examining how to leverage these mechanisms to achieve effective teamwork despite the challenges. Their work provides valuable insights that showcase the importance of centralized decision-making, team effort, team conflict, and knowledge creation (Arumugam, Antony, and Linderman 2016; de Vries et al. 2022; Franke, Eckerd, and Foerstl 2022).

A few studies have also investigated the role of direct interactions among team members, particularly focusing on communication (Malhotra, Ahire, and Shang 2017). Two noteworthy observations arise from the existing research on communication in cross-functional teams. First, team processes are shaped by dynamic communication patterns (Lehmann-Willenbrock 2025). However, emerging supply chain studies tend to reduce communication in cross-functional teams to generic, broad evaluations. Many studies have suggested that communication is deemed effective when it is positive, open, active, and frequent but detrimental when it is negative, siloed, passive, and infrequent (Bruccoleri, Riccobono, and Größler 2019; Driedonks, Gevers, and Weele 2010; Malhotra, Ahire, and Shang 2017; Mehta and Mehta 2018; Montoya, Massey, and Lockwood 2011). This article challenges this consensus, arguing that such broad evaluations may oversimplify the complexities of communication by overlooking the interactional and temporal contexts in which it unfolds. To provide a more nuanced understanding of communication effectiveness (or lack thereof) in cross-functional teams, this article examines communication patterns—that is, the sequences of verbal exchanges between team members in real time (Lehmann-Willenbrock 2025).

Second, the discourse on cross-functional teams mainly focuses on formal, task-oriented aspects of teamwork (e.g., Arumugam, Antony, and Kumar 2013; de Vries et al. 2022), which may obscure the role of relational dynamics in team performance (e.g., Gifford et al. 2022; Kaufmann, Wagner, and Carter 2017). To account for such relational dynamics in teams and follow the call for more attention to behavioral interaction phenomena, this article examines relational communication patterns. Specifically, it asks two main questions: (1) *Which relational communication patterns manifest in cross-functional teams?* and (2) *How do these patterns influence team performance improvement?*

To answer these questions, this article draws on interaction ritual theory (Collins 2005) and incorporates insights from team and communication research (e.g., Bales 1950; van Dun and Wilderom 2021). The central argument presented is that specific relational communication patterns (defined as how one team member reacts to another team member's relational communication, signaling one form of interaction ritual) are critical in early cross-functional team meetings. These patterns set the foundation for team performance improvement, defined as a positive change in team performance over time (van Iddekinge et al. 2009). In line with core team learning principles, we anticipate that all teams will improve (Marks, Mathieu, and Zaccaro 2001), but our focus is on why some improve more than others. A stronger improvement in performance over time reflects a positive team outcome, whereas a weaker improvement is seen as detrimental, as it indicates falling below the improvement baseline and lagging behind other teams. Following the literature, relational communication is differentiated from task-oriented communication and counterproductive communication (e.g., Bales 1950; van Dun and Wilderom 2021). Accordingly, we investigate how relational statements followed by either task-oriented or counterproductive responses (see Figure 1) influence team outcomes.

Methodologically, this article investigates communication patterns in 32 cross-functional teams participating in a complex supply chain management simulation (i.e., The Fresh Connection [TFC]; see de Vries et al. 2022; van den Adel, de Vries, and van Donk 2022). Using a novel approach to interaction coding, this article assigns specific communication codes to each verbal sense unit, accounting for the entire stream of team interactions. It assesses the communication patterns of 130 individuals during their first and last team meetings in the simulation, totaling 42 h and 28 min of recorded meetings and 25,641 coded behaviors. The quantitative analyses were complemented with ad hoc qualitative insights.

This article makes three main theoretical contributions. First, it challenges the prevailing conceptualization of team processes and dynamics in the supply chain literature by adopting a micro-level focus on interaction rituals, particularly communication patterns. This approach moves beyond the broad evaluations of communication emphasized in prior studies. In doing so, this article also responds to recent calls for research on the impact of team communication on performance improvement (e.g., van Dun and Wilderom 2021). Second, this article contributes to the ongoing debate about the interplay of relational and task-focused processes in cross-functional teams (Bruccoleri, Riccobono, and Größler 2019; Lonsdale, Sanderson, and Esfahbodi 2024). By highlighting the importance of relational communication, it extends prior research that predominantly focuses on task-oriented factors, offering a complementary understanding of effective cross-functional teams (e.g., Lonsdale, Sanderson, and Esfahbodi 2024; van Dun and Wilderom 2021). Third, by introducing interaction ritual theory alongside interaction coding and pattern analysis methodology to the supply chain management field, this article offers a novel approach to understanding cross-functional teams. Specifically, by demonstrating the crucial role of communication patterns, it encourages future research to enrich theoretical and methodological perspectives on cross-functional team processes and dynamics and their impact on team performance improvement. In the next section, we outline the theoretical foundations of our study and develop our hypotheses.

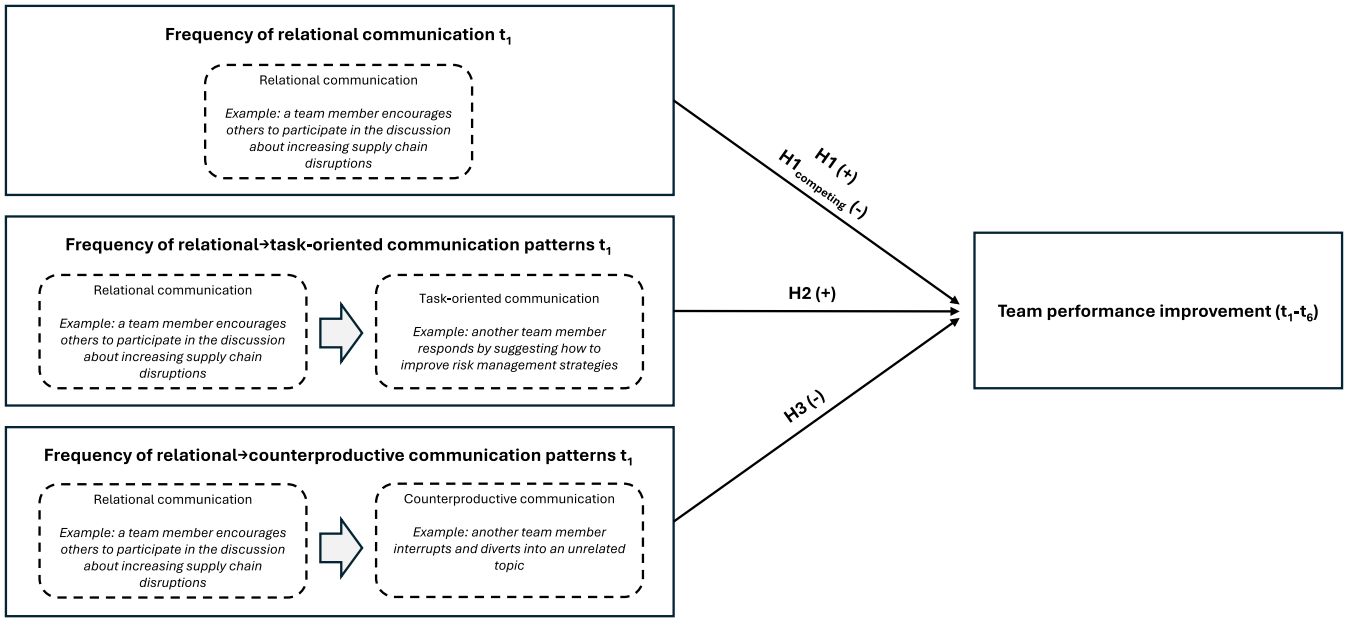

FIGURE 1 | Research model. [Colour figure can be viewed at wileyonlinelibrary.com]

2 | Literature and Hypotheses

2.1 | Team Processes and Dynamics in Cross-Functional Teams

As cross-functional teams are widely used in organizations to manage supply chains, it has become crucial to understand what differentiates effective teams from less effective ones (Driedonks, Gevers, and Weele 2010). Research on cross-functional teams, which are interdepartmental groups jointly managing supply chain decisions, has grown since the early 2000s (e.g., Carter et al. 2024; de Vries et al. 2022; Lu, Kaufmann, and Carter 2021; Wu, Loch, and Ahmad 2011). A closer review reveals two important observations.

First, most articles investigate specific *characteristics* of cross-functional teams (i.e., members' knowledge, skills, abilities, personality, and demographic characteristics, Mathieu et al. 2017) or *emergent states* in cross-functional teams (i.e., dynamic cognitive, affective, and motivational states such as cohesion and goal alignment, Rapp et al. 2021). For example, Kaufmann and Wagner (2017) demonstrate that specific team attributes—such as affective diversity and emotional intelligence—predict cohesion, which in turn enhances performance. However, the dominant focus on team characteristics and emergent states cannot speak to more dynamic and fluid *team processes and dynamics* (i.e., team members' interdependent acts reflected in cognitive, verbal, and behavioral activities such as decision-making and communication (Mathieu et al. 2017). These processes and dynamics are essential for cross-functional team success because they determine how effectively a diverse knowledge base is translated into team performance (e.g., Malhotra, Ahire, and Shang 2017). This pinpoints a critical need for novel theoretical approaches and empirical insights.

Taking steps toward understanding team processes and dynamics, supply chain scholars have started paying attention to communication within teams (Driedonks, Gevers, and Weele 2010; Malhotra, Ahire, and Shang 2017; Montoya, Massey, and Lockwood 2011; Sanderson, Esfahbodi, and Lonsdale 2022). While providing valuable insights, prior studies typically focus on the broad and generic characteristics of communication rather than capturing the social interactions that define team processes and dynamics (Lehmann-Willenbrock 2025). For instance, while Driedonks, Gevers, and Weele (2010) highlight the importance of communication frequency and quality for cross-functional team effectiveness, their survey-based measures are not meant to capture the temporal and interactional complexity of communication. Moving beyond survey-based methods, Montoya, Massey, and Lockwood (2011) examine the frequency of team communication as the number of messages sent in a virtual reality simulation in which members had to collaborate on a joint task. However, this approach does not include the specific content and context of team interactions. More recently, Sanderson, Esfahbodi, and Lonsdale (2022) show that a decentralized, open, and informal communication style is beneficial for cross-functional teamwork effectiveness. This stream of work underscores the critical role of communication in cross-functional teams. The present article extends this by conceptualizing team communication as an interactional, contextual, and dynamic phenomenon (Lehmann-Willenbrock 2025).

A second observation from the review of research on cross-functional teams is that most studies prioritize task-oriented processes (e.g., decision-making, knowledge creation) over relational phenomena (e.g., providing support, sharing feelings). This emphasis is surprising given that both hard skills (i.e., task-oriented skills, such as business process mapping) and soft skills (i.e., relational skills, such as communication) in teams are essential for operational performance (Bruccoleri, Riccobono, and Größler 2019). Lonsdale, Sanderson, and Esfahbodi (2024) similarly highlight the importance of balancing taskwork (e.g., a sourcing strategy) and teamwork (e.g., communication) to ensure cross-functional team effectiveness. Thus, while scholars increasingly recognize that the success of cross-functional teams relies on both task-oriented and

relational factors, the research landscape pays much greater attention to the task domain. This imbalance is reflected in the calls for more research on the often-overlooked relational side of supply chain management (Avgerinos and Gokpinar 2017; Gifford et al. 2022; Jacobs, Yu, and Chavez 2016). Thus, while a broad consensus exists on the importance of communication and relational dynamics for performance in cross-functional teams, the present article challenges conventional conceptualization by focusing on relational communication patterns as central to understanding the core processes and dynamics within cross-functional teams.

2.2 | Communication Patterns in Cross-Functional Teams

Interaction ritual theory provides a comprehensive theoretical lens through which to examine team processes and dynamics by explaining social phenomena through the structure of concrete situations (Collins 2005; Goffman 1967; Krishnan et al. 2021). Specifically, it posits that interaction rituals (i.e., patterns of interpersonal behaviors such as communication) are essential to the development and effectiveness of social groups, as they promote shared emotional experiences and a joint attentional focus among individuals (Collins 2005; Wang et al. 2023). While originating in sociology, interaction ritual theory has recently gained traction in general management and organizational behavior research (Krishnan et al. 2021; Lehmann-Willenbrock et al. 2017; Metiu and Rothbard 2013; Wang et al. 2023). For example, Metiu and Rothbard (2013) apply it to investigate team engagement in software development teams, highlighting the role of frequent, informal interactions in fostering engagement and driving problem-solving breakthroughs. Given its core propositions and applications, interaction ritual theory helps explain how communication patterns within a cross-functional team (i.e., how one team member reacts to another member's statement, which signals one form of interaction ritual) form the basis of team performance improvement.

Interaction ritual theory not only offers a solid theoretical basis for examining ritualized interactions, such as communication patterns within teams, but it also provides a solution to a common challenge present in prior studies on team communication. Specifically, the literature seems to focus primarily on the absolute frequencies of specific types of communication. This approach overlooks how communication is embedded in the interactional flow of a team (i.e., how other team members respond to a communicative act). One notable exception is Bennett et al. (2008), who find that, while communication frequency does not account for differences in team effectiveness, specific patterns of information seeking and sharing reveal how certain teams stabilize their performance. In another study, Kauffeld and Lehmann-Willenbrock (2012) show that more relational communication in teams is associated with lower team satisfaction. Subsequent research suggests that this counterintuitive finding may arise from an exclusive focus on communication frequencies, which overlooks the interactional context (i.e., communication patterns), thereby leading to an incomplete or potentially misleading interpretation (Lehmann-Willenbrock and Allen 2018).

This article extrapolates from these research streams to propose that translating the terminology and rationale of interaction ritual theory to supply chain management provides a useful theoretical foundation for identifying relevant communication patterns that influence cross-functional team performance (Hoogeboom and Wilderom 2020). In addition, as interaction ritual theory itself remains silent on the content of successful versus unsuccessful communication patterns, or what are termed team rituals, this article complements this theory by drawing on fundamental insights from communication research.

Before discussing communication patterns in cross-functional teams, the basic components of these patterns should be outlined. Based on the fundamentals of human interaction (Bales 1950), the supply chain literature typically distinguishes between two overarching functions of communication in teams: (i) collaborating on and coordinating team tasks and (ii) maintaining relationships within the team. For example, Pagell et al. (2015) note that relational coordination in teams, which is deemed crucial for achieving operational success, depends on both formal task-oriented structures and interpersonal relationships. Similarly, Bruccoleri, Riccobono, and Größler (2019) argue that an effective and efficient team requires members to demonstrate both technical and soft skills. More recently, Lonsdale, Sanderson, and Esfahbodi (2024) differentiate between taskwork and teamwork, highlighting their joint importance in enhancing supply chain team effectiveness.

Translating this distinction into concrete team processes, scholars identify two types of verbal communication in teams, namely, (1) *task-oriented communication* to accomplish task work and achieve a high-quality solution, such as solving problems or sharing knowledge, and (2) *relational communication* to show appreciation of other team members and improve interpersonal relations, such as providing support or sharing humor within a team (Bales 1950; Liao et al. 2023; van Dun and Wilderom 2021). While both task-oriented and relational communication are inherently goal-directed and aim to improve taskwork and relationships (even though the intended effect is not guaranteed), they alone do not provide a complete picture of communication within cross-functional teams. This is because communication can also be classified as counterproductive (Kauffeld and Lehmann-Willenbrock 2012; van Dun and Wilderom 2021). (3) *Counterproductive communication* disrupts task progress or damages relationships, often through distracting or criticizing (e.g., Bakhtiar, Webster, and Hadwin 2018; Bales 1950). This tripartite differentiation of communication types has also been noted by van Dun and Wilderom (2021), finding that effective leaders in lean workfloor teams are characterized by low levels of counterproductive communication and a balance of relational and task-oriented communication.

Drawing on interaction ritual theory (Collins 2005), this article extends the established differentiation of three communication types by investigating how communication *patterns* can boost, maintain, or diminish the performance improvement of cross-functional teams. It specifically focuses on relational communication patterns (i.e., patterns starting with relational communication; Bales 1950). While relational communication is relevant across various team types, its role is particularly vital for cross-functional teams for two main reasons. First, the

supply chain literature repeatedly suggests the importance of relational factors for cross-functional team performance. For example, Kaufmann and Wagner (2017) show how emotional intelligence increases the effectiveness of procurement teams, while Avgerinos and Gokpinar (2017) emphasize relational dynamics as the key to overcoming failures in surgical teams. Similarly, Oliveira, Argyres, and Lumineau (2022) underscore the importance of friendly communication within supply chain teams for successfully adapting to disruptions, and Gifford et al. (2022) stress the need to study team dynamics for better integration and performance. Second, relational communication plays a greater role for cross-functional teams compared with other forms of teamwork, as members in such teams have to particularly avoid communication problems in order to synergize their diverse resources and competencies when jointly performing supply chain tasks (e.g., Lu, Kaufmann, and Carter 2021).

When performing tasks, interactions within cross-functional teams ideally serve the overarching goal of achieving operational excellence (Ambrose, Matthews, and Rutherford 2018). Thus, based on the theoretical rationale outlined earlier, this article suggests that a common communication pattern in cross-functional teams involves a relational statement followed by a task-oriented response (i.e., a relational → task-oriented communication pattern). Further, given the inevitable clash of different goals and opinions in cross-functional teams (Kaufmann, Wagner, and Carter 2017), this article also proposes that another important communication pattern entails a relational statement followed by a counterproductive statement (i.e., a relational → counterproductive communication pattern).

2.3 | Hypothesis Development

Scholars in supply chain and general management have empirically shown that early interaction patterns in teams set the stage for subsequent interactions and outcomes (e.g., Ericksen and Dyer 2004; Lu, Kaufmann, and Carter 2021; Mathieu and Rapp 2009; van Dun and Wilderom 2021). Building on this line of research, this article focuses on relational communication in the early phases of cross-functional teamwork and its impact on subsequent team performance improvement. This research examines team improvement as a crucial team outcome because, in line with team learning principles, a positive development in team performance across time is expected, but it is not clear which factors lead to stronger or weaker improvement (de Leeuw, Schippers, and Hoogervorst 2015). Following the consensus of extant research, this paper first considers the overall frequency of relational communication in early team interactions and then shifts the focus to communication patterns (Driedonks, Gevers, and Weele 2010; Montoya, Massey, and Lockwood 2011).

The frequency of relational communication is defined as the number of relational statements per team in the first meeting (Kauffeld and Lehmann-Willenbrock 2012). Given the mixed results and conflicting theoretical views of previous work on relational communication in teams (e.g., Jämsen, Sivunen, and Blomqvist 2022; Kauffeld and Lehmann-Willenbrock 2012), the relationship between the mere frequency of relational communication and team performance improvement can be hypothesized in two opposing ways.

On the one hand, the emotional focus mechanism postulated in interaction ritual theory suggests that successful relational communication can boost a team's shared emotional focus and emotional energy (Collins 2005). Elevated emotional energy levels among team members, in turn, foster effective teamwork (Kaufmann, Wagner, and Carter 2017; Methot et al. 2021). Moreover, substantial evidence shows that relational communication promotes well-being and trust, which are essential for team performance (Agarwal and Narayana 2020; Jämsen, Sivunen, and Blomqvist 2022; Sias 2005; Vuorela 2005). Consistent with these findings, effective teams have been found to engage in more relational communication (Lu, Kaufmann, and Carter 2021; Staudinger 2005). Thus, both theoretical arguments from interaction rituals and empirical evidence underscore the potential benefits of relational communication for team effectiveness. Put formally:

Hypothesis 1. *The frequency of relational communication during early team interactions is positively related to the performance improvement of cross-functional teams; that is, more relational communication is associated with stronger performance improvement.*

On the other hand, interaction ritual theory emphasizes the importance of joint attentional focus for team effectiveness (Collins 2005). Thus, relational communication could hinder team performance if perceived as "off-topic" or unrelated to task completion (Kauffeld and Lehmann-Willenbrock 2012; Methot et al. 2021). Moreover, the frequent use of relational communication can foster groupthink in teams (Keyton 1999). Supporting this perspective, Kauffeld and Lehmann-Willenbrock (2012) find a negative relationship between relational communication and team meeting satisfaction. Similarly, van Dun and Wilderom (2021) observe that relational communication impedes the performance of lean workfloor teams. Drawing on this alternative rationale rooted in the attentional mechanism proposed by interaction ritual theory, this article presents the following competing hypothesis:

Hypothesis 1 $_{\textbf{competing}}$**.** *The frequency of relational communication during early team interactions is negatively related to the performance improvement of cross-functional teams; that is, more relational communication is associated with weaker performance improvement.*

While the role of the frequency of relational communication remains ambiguous, the core tenet of interaction ritual theory holds that relational communication *patterns* (i.e., how one team member reacts to another member's relational communication) may play a more dominant role in overall team outcomes (Collins 2005). Recent supply chain literature echoes this idea, highlighting the "importance of dynamic interactions within and across organizational units" for operational performance (van Dun and Wilderom 2021, 88; Hoogeboom and Wilderom 2020). For the present research, this suggests a need to examine behavioral patterns beyond the mere frequency of specific communication types and to assess their impact on cross-functional team performance. Specifically, relational communication may affect team performance not only through its frequency but also through its embeddedness in the team interaction flow and its potential to trigger task-oriented communication.

Therefore, the second hypothesis of this article considers systematic patterns of relational and task-oriented communication and their relationship to team performance improvement. An example of a relational → task-oriented communication pattern (see Figure 1) during a cross-functional team meeting would be that when the team is facing increasing upstream supply disruptions, a team member might encourage others to participate in the discussion (i.e., relational communication). Another team member may respond by suggesting ways to improve risk management strategies (i.e., task-oriented communication). This communication pattern exemplifies a positive upward team interaction ritual wherein team members increasingly acknowledge shared goals and build positive emotional experiences within the team (Collins 2005, 50). Such interaction rituals create both emotional energy and attentional focus, establishing a solid foundation for continuous improvement, thereby boosting team performance improvement (Goffman 1967). Therefore, it is expected that functional communication patterns (i.e., relational → task-oriented communication patterns) during the initial phase of teamwork in cross-functional teams are associated with greater performance improvement in subsequent phases:

Hypothesis 2. *Relational → task-oriented communication patterns during early team interactions are positively related to the performance improvement of cross-functional teams; that is, more of such patterns are associated with stronger performance improvement.*[1]

In view of the three communication types in teams (relational, task, and counterproductive), relational communication patterns can also comprise a relational communicative act, followed by a counterproductive one. A relational → counterproductive communication pattern in cross-functional meetings is illustrated, for example, in a situation in which one team member encourages another person's participation on the topic of outsourcing outbound warehousing (i.e., relational communication), and the other person responds by drifting off into side conversations with other team members or even interrupting or undermining the speaker's encouragement (i.e., counterproductive communication). Such a communication pattern represents a negative downward interaction ritual because team members lose their sense of shared goals and drift away from collective emotional expression (Collins 2005; Krishnan et al. 2021). This disruption of shared team focus and emotional energy likely hinders performance improvement. Therefore, cross-functional teams that more frequently experience relational → counterproductive communication patterns in the initial teamwork phase are expected to show weaker performance improvement over the subsequent phases:

Hypothesis 3. *Relational → counterproductive communication patterns during early team interactions are negatively related to the performance improvement of cross-functional teams; that is, more such patterns are associated with weaker performance improvement.*

Figure 1 summarizes the research model and proposed hypotheses.

3 | Methods

This research adopts a pragmatic philosophy, recognizing that various interpretations of the world exist and that no single perspective can provide a complete picture of a phenomenon (Kaushik and Walsh 2019). Accordingly, it combines quantitative analysis in the main study with an ad hoc qualitative study to address the research question from complementary angles.

3.1 | Sample and Data Collection

Data were collected from self-managed teams of graduate students majoring in supply chain management at VU University in Amsterdam. Participants engaged in six rounds of a team simulation called *TFC* over 3 weeks embedded in a supply chain management course (see Figure 2 for the study procedure). A student sample is appropriate for behavioral research, particularly for testing theories such as interaction ritual theory, which does not require a professional sample for its scope conditions (Thomas 2011). Moreover, recruiting a professional sample for such a team simulation would be extremely challenging due to time commitments and coordination difficulties for over 100 professionals.

TFC has been widely used in the psychology field (e.g., Brazhkin and Zimmerman 2019; Schippers and Rus 2021), and it has recently gained attention in supply chain research (e.g., de Vries et al. 2022; van den Adel, Vries, and Donk 2022). In the present study, participants were first randomly assigned to self-managed teams of three to five members. If individuals had prior formal collaboration, adjustments were made to ensure that they were not placed on the same team, thus maintaining comparability. Furthermore, no participant had prior experience with TFC. The sample comprised 130 participants, allocated across 32 teams (mean = 4.06 members per team, $SD = 0.35$), with an average age of 23.84 years ($SD = 1.23$) and 31% female participants per team.

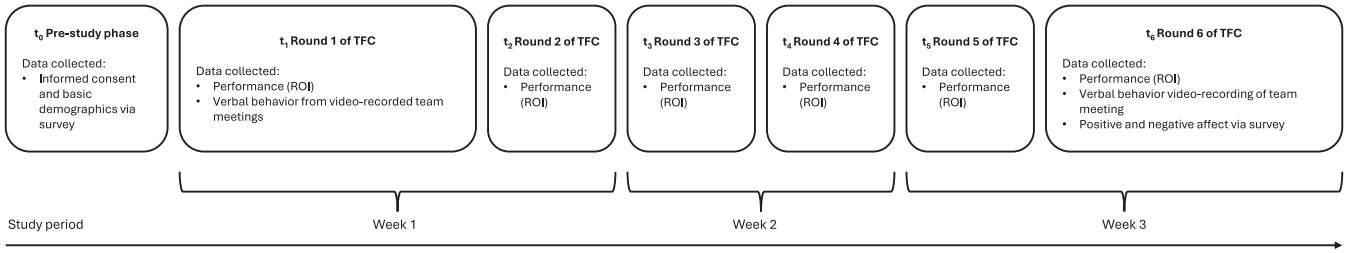

FIGURE 2 | Study procedure.

Each team in TFC managed a loss-making fruit juice company with four roles: VP Sales, VP Supply Chain, VP Operations, and VP Purchasing. In teams of three, one member takes two roles; in teams of five, one member takes on the observer role. Over six rounds, each simulating 6 months of management decisions, teams made strategic supply chain decisions—such as those related to suppliers, production speed, shelf life, and pallet location—with each role handling an interdependent scope (see de Leeuw, Schippers, and Hoogervorst 2015). These decisions required balancing conflicting functional interests to optimize team performance (i.e., maximizing the ROI). As the simulation emphasizes strategic learning rather than cumulative performance, prior rounds do not affect subsequent ones. Overall, TFC serves as an appropriate tool for investigating communication processes and dynamics in cross-functional teams and their effects on team performance (de Vries et al. 2022; Schippers and Rus 2021).

Participants were informed that their first and last team meetings would be video-recorded, and they were asked to complete a short survey afterward. They were assured that their consent and the recordings would not affect their treatment or grading and that their data would be anonymized for research purposes in line with GDPR standards. One team declined to be recorded and was excluded from the study. Those who consented completed an informed consent form and a brief demographic questionnaire before the first meeting. They were then video recorded during the first and last meetings, and after each, they completed a survey on their emotional experiences.

Research assistants set up the video cameras with built-in microphones before the teams arrived and ensured good audio quality. Each team was recorded separately. Prior research demonstrates that participants exhibit low reactivity to video recording in team meetings, with behavior closely resembling that of non-recorded participants (Kauffeld and Lehmann-Willenbrock 2012). Demand effects were less of a concern here than in experimental settings (Eckerd et al. 2021), as participants were observed in a natural setting without overt manipulation or direct interactions with researchers (one co-author taught the course but was unaware of the hypotheses before data collection). Following TFC-based studies (Schippers and Rus 2021), simulation performance represented a small portion of the course grade to incentivize participation and prevent cross-team collaboration. Participants could opt out at any time without explanation.

For each of the six rounds, an overall ROI (i.e., performance data) was extracted from the TFC simulation for each team based on their decisions. Of the 33 teams that agreed to participate, one was excluded at t_1 and five at t_6 due to insufficient audio quality, resulting in sample sizes ranging from $N = 27$ teams (for the ancillary analyses of the communication at t_6) to $N = 32$ (for all other analyses). Team meetings averaged 43 min and 35 s ($SD = 4{:}28$, ranging from 27 to 45 min). The videos from 32 teams at t_1 and 27 teams at t_6 totaled 42 h and 28 min. These recordings were analyzed using a fine-grained quantitative interaction coding procedure (Kauffeld, Lehmann-Willenbrock, and Meinecke 2018), resulting in 25,641 coded behaviors (i.e., 13,983 at t_1 and 11,658 at t_6). The final sample characteristics are provided in Appendix S1.

3.2 | Coding of Communication

This research employed interaction coding to extract team members' specific verbal behaviors during meetings, facilitated by Interact software (Version 14; Mangold International 2010).[2] Research assistants used the act4team coding scheme (see Table 1) to assign one code to each sense unit (i.e., the smallest meaningful speech segment containing a complete thought; Bales 1950) that occurred during a team meeting. One sense unit is typically a simple sentence consisting of a subject and predicate (e.g., "I agree") or a single word (e.g., "Okay"). In line with the best practices (Güntner, Meinecke, and Lüders 2023), sense units were separated when (1) the speaker changed; (2) one speaker voiced several statements, each with a complete thought (e.g., giving feedback and then identifying a problem); or (3) one speaker shifted the main argument within the same communication type (e.g., identifying three different problems in a row). This coding approach allowed for ruling out overlapping codes and patterns (see Table 2 for examples of verbatim transcripts illustrating task-oriented or counterproductive responses to relational communication).

Four trained research assistants conducted the interaction coding of video-recorded meetings using a subset approach. A random sample of 11 videos was double-coded by two research assistants (i.e., 22 videos were coded twice at t_1 and t_6). The inter-rater reliability for these subsets was satisfactory ($\kappa = 0.76$), comparable to prior studies where inter-rater reliability typically ranged from 0.70 to 0.90 (e.g., Gerpott et al. 2019). Further, according to Landis and Koch (1977), κ-values between 0.61 and 0.80 indicate *substantial* inter-rater agreement. After the coding of all video recordings, the frequencies of each verbal type were aggregated at the team level (i.e., all individual codes per type and team were added up). Following best practices (Gerpott et al. 2019; Meinecke, Lehmann-Willenbrock, and Kauffeld 2017), the aggregated values were standardized by dividing the number of codes per type by the meeting duration in minutes and multiplying them by 45 (i.e., the standard meeting length). Raw and time-stamped data were used for sequential analyses.

3.3 | Analysis Strategy

The aggregated data and analysis code for this study are available on the Open Science Framework.[3] A detailed description of the analysis strategy is available from the authors upon request, with key analytical elements integrated into the results section below.

4 | Results

The following results emerged from our analyses. Table 3 displays descriptive statistics and correlations concerning the average ROI, communication types, relational communication patterns, and team demographics. Figure 3 shows that the average weekly ROI of the participating teams constantly increased, which is in line with TFC as a learning experience. In the following section, linear latent growth models were first estimated

TABLE 1 | Categories of communication types and corresponding verbal codes.

Relational communication	Task-oriented communication	Counterproductive communication
Definition	Definition	Definition
Using praise and other forms of recognition to support and show appreciation of other team members and to improve interpersonal relationships	Solving problems and sharing or clarifying task-related knowledge to accomplish taskwork and achieve a high-quality solution	Off-task communication that distracts from the actual taskwork or uncivil communication that jeopardizes interpersonal relationships
Verbal codes • Encouraging participation • Providing support • Active listening • Reasoned disagreement • Giving feedback • Humor and laughter • Separating opinions from facts • Expressing feelings • Offering praise • Personal responsibility	Verbal codes • Identifying a problem • Describing a problem • Identifying a solution • Describing a solution • Connection with problems • Connection with solution • Weighing costs/benefits • Summarizing • Visualizing • Goalsetting	Verbal codes • Losing train of thought in details and examples • Criticizing • Interrupting • Side conversation • Self-promotion • No interest in change • Complaining • Empty talk • Blaming • Denying responsibility • Terminating the discussion

Note: These categories are based on and adapted from the act4teams coding scheme by Kauffeld, Lehmann-Willenbrock, and Meinecke (2018) to reflect the differentiation of relational, task-oriented, and counterproductive communication.

TABLE 2 | Examples of relational → task-oriented and relational → counterproductive communication patterns.

Response following relational communication	Communication pattern	Example
Task-oriented	Organizational knowledge[a] • Providing support (relational) • Connection with a solution (task-oriented)	A: This will be very flexible. (*referring to a procedure in TFC and pointing at the screen*) B: Yes, yes. (*nodding*) A: Then, we change the transportation costs.
	Defining the objective[a] • Active listening (relational) • Describing a solution (task-oriented)	A: We have to try to work together [...]. B and C: Hmm ... Yeah ... D: That's how we can only change the direct payment. (*pointing at the screen*)
Counterproductive	Separating opinion from facts (relational) • Blaming (counterproductive)	A: Yeah, I personally do not know if this is right. B: I thought you (*emphasized*) should have said that beforehand.
	Organizational knowledge[a] • Active listening (relational) • Side conversation (counterproductive)	A: You can make the decisions and control the changes (*referring to the functions of TFC*). B: (*Nodding and looking at A while they speaks*). C and D: See here ... (*talking about a different topic*).

[a]In some cases, the first statement is added to provide sufficient context to understand each communication pattern. Only the last two statements of each example represent those communication patterns that are relevant to the hypotheses.

to extract the extent of team performance improvement, which allowed for testing Hypothesis 1 by assessing the impact of the mere frequency of relational communication on the extent of team performance improvement (i.e., from weaker to stronger improvement). Second, hypothesis-testing results regarding how relational → task-oriented and relational → counterproductive communication patterns predict team performance improvement are presented. To complement these findings,

TABLE 3 | Descriptive statistics and correlations of study variables (team-level).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Average ROI															
2. Performance improvement (slope)	−0.01 (0.96)														
3. Relational communication (t_1)	−0.14 (0.43)	−0.48 (0.005)													
4. Task-oriented communication (t_1)	0.07 (0.72)	−0.23 (0.20)	0.61 (<0.001)												
5. Counterproductive communication (t_1)	0.04 (0.81)	−0.21 (0.25)	0.53 (0.02)	0.39 (0.03)											
6. Relational → task-oriented patterns (t_1)	−0.03 (0.93)	−0.30 (0.28)	0.69 (<0.001)	0.85 (<0.001)	0.34 (0.08)										
7. Relational → counterproductive patterns (t_1)	−0.09 (0.64)	−0.41 (0.02)	0.50 (0.02)	0.08 (0.51)	0.73 (<0.001)	0.30 (0.20)									
8. Relational communication (t_6)[a]	−0.35 (0.07)	−0.56 (0.002)	0.50 (0.008)	0.31 (0.12)	0.31 (0.11)	0.39 (0.23)	0.52 (0.006)								
9. Task-oriented communication (t_6)[a]	−0.18 (0.38)	−0.34 (0.09)	0.50 (0.008)	0.59 (0.001)	0.24 (0.23)	0.66 (0.001)	0.25 (0.18)	0.67 (<0.001)							
10. Counterproductive communication (t_6)[a]	−0.25 (0.21)	−0.37 (0.05)	0.41 (0.04)	0.30 (0.13)	0.46 (0.02)	0.35 (0.18)	0.54 (0.003)	0.60 (<0.001)	0.38 (0.05)						
11. Relational → task-oriented patterns (t_6)[a]	−0.28 (0.16)	−0.43 (0.03)	0.59 (0.001)	0.47 (0.01)	0.15 (0.47)	0.49 (0.01)	0.29 (0.14)	0.70 (<0.001)	0.92 (<0.001)	0.30 (0.14)					
12. Relational → counterproductive patterns (t_6)[a]	−0.21 (0.29)	−0.34 (0.08)	0.34 (0.08)	0.13 (0.52)	0.49 (0.009)	0.09 (0.66)	0.57 (0.002)	0.51 (0.006)	0.16 (0.41)	0.80 (<0.001)	0.16 (0.43)				
13. Positive affect (t_6)[c]	−0.06 (0.74)	0.09 (0.64)	0.17 (0.35)	0.31 (0.09)	0.06 (0.78)	0.15 (0.22)	−0.11 (0.63)	0.16 (0.44)	0.29 (0.14)	−0.03 (0.89)	0.19 (0.35)	−0.08 (0.69)			
14. Negative affect (t_6)[c]	−0.28 (0.12)	−0.35 (0.049)	0.53 (0.002)	0.39 (0.03)	0.25 (0.16)	0.41 (0.02)	0.33 (0.05)	0.34 (0.09)	0.20 (0.32)	0.09 (0.66)	0.32 (0.10)	0.17 (0.41)	0.26 (0.04)		
15. Gender ratio[b]	−0.26 (0.15)	−0.05 (0.10)	0.22 (0.23)	−0.04 (0.82)	−0.05 (0.77)	0.01 (0.85)	0.05 (0.78)	0.08 (0.67)	0.15 (0.44)	−0.26 (0.20)	0.35 (0.08)	−0.08 (0.70)	0.26 (0.15)	0.32 (0.08)	
M	−0.45	2.14	122.49	85.23	17.61	25.95	5.05	136.47	110.47	31.50	30.63	8.98	2.53	1.60	0.31
SD	2.95	0.95	54.48	66.31	12.90	19.09	4.55	73.22	71.77	19.45	17.51	6.91	0.37	0.31	0.16

Note: *p*-values are provided in parentheses.

[a]Smaller sample size due to the insufficient video quality of five teams, $N = 27$ teams consisting of $N = 110$ participants in total.

[b]Range between 0 = only males and 1 = only females.

[c]Positive and negative affect were calculated by averaging team members' assessments using the Positive and Negative Affect Schedule (Thompson 2007) administered after the last round of the TFC.

ancillary analyses based on the final short survey of team members' emotional experiences after the last team meeting are also reported.

4.1 | Hypotheses Testing

To test Hypotheses 1 and $1_{competing}$, regarding the positive or negative role of relational communication for team performance improvement, the analysis examined how the mere frequencies of relational communication relate to team performance improvement (i.e., without considering their interactional context), while controlling for task-oriented and counterproductive communication. We included relational, task-oriented, and counterproductive communication as predictors, recognizing that these behaviors rarely occur in isolation and must be understood in concert (Gerpott et al. 2019). Linear latent growth models of team performance (i.e., ROI) were estimated across the six rounds of TFC. The individual slope value of each team, representing the extent of their performance improvement, was extracted and used as the outcome variable in a linear regression model.

The results displayed in Table 4 support Hypothesis $1_{competing}$, indicating that relational communication was a negative predictor of team performance improvement; that is, more relational communication went along with weaker performance improvement ($B = -0.01$, $SE = 0.004$, $p = 0.02$; 95% CI [−0.01; −0.02], $\eta^2 = 0.18$). To illustrate, this means that each relational statement in the first meeting reduced the team's subsequent performance improvement by −0.01. While all teams showed a performance improvement from t_1 to t_6, the extent to which this improvement was predicted by communication in the first team meeting. In particular, this finding seems to suggest that the more relational communication teams used at t_1, the weaker the team performance improvement over the six rounds. Additionally, regarding the other two types of communication, neither task-oriented ($B = 0.001$, $SE = 0.003$, $p = 0.65$, 95% CI [−0.004; 0.01], $\eta^2 = 0.002$) nor counterproductive communication ($B = 0.003$, $SE = 0.01$, $p = 0.80$, 95% CI [−0.03; 0.03], $\eta^2 = 0.01$) was found to be associated with team performance improvement.

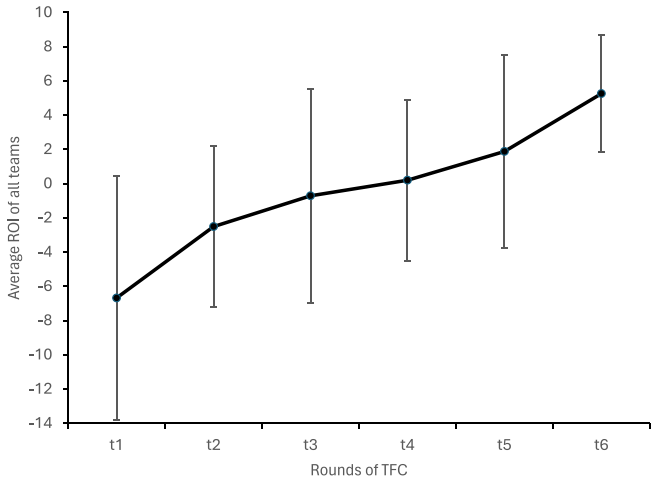

FIGURE 3 | Average team performance improvement over six rounds of TFC. [Colour figure can be viewed at wileyonlinelibrary.com]

Appendix S2 reports the results with controls for gender (male-to-female ratio) and nationality (Dutch-to-non-Dutch ratio). These factors can influence verbal interactions, team dynamics, and performance (Ayub and Jehn 2018; Garcia et al. 2022). The results remain consistent with these controls and are robust when using weighted regressions (see Appendix S3). The same pattern of results was found when using the duration, rather than frequency, of the communication types as predictors (see Appendix S4). Finally, a test for a potential curvilinear relationship between relational communication and performance improvement did not yield statistically significant results (see Appendix S5).

To test Hypotheses 2 and 3, hypothesizing the role of relational communication patterns for performance improvement, the frequencies of relational → task-oriented and relational → counterproductive communication patterns for each team were calculated using sequential analysis (i.e., the transition frequencies of relational communication being followed by task-oriented or counterproductive communication, respectively). These frequencies were then included in a regression model to predict the extent of team performance improvement. As displayed in Table 5, relational → task-oriented communication patterns were not found to be associated with team performance improvement ($B = -0.005$, $SE = 0.009$, $p = 0.54$, 95% CI [−0.02; 0.01], $\eta^2 = 0.01$), thus not supporting Hypothesis 2. Further, relational → counterproductive

TABLE 4 | Team performance improvement regressed on communication types.

Variable	*B*	*SE*	*p*	95% CI	η^2
Intercept	3.17	0.39	< 0.001	[2.38; 3.96]	
Relational communication (t_1)	−0.01	0.004	0.02	[−0.01; −0.02]	0.18
Task-oriented communication (t_1)	0.001	0.003	0.65	[−0.004; 0.01]	0.002
Counterproductive communication (t_1)	0.003	0.01	0.80	[−0.03; 0.03]	0.01
R^2					
Communication types only	0.24				

Note: $N = 32$ teams consisting of $N = 130$ participants in total. The results remain consistent when controlling for gender ratio and Dutch to non-Dutch ratio (see Appendix S2).

TABLE 5 | Team performance improvement regressed on communication patterns.

Variable	*B*	*SE*	*p*	95% CI	η^2
Intercept	2.68	0.30	< 0.001	[2.07; 329]	
Relational → task-oriented communication pattern (t_1)	−0.005	0.009	0.54	[−0.02; 0.01]	0.01
Relational → counterproductive communication pattern (t_1)	−0.08	0.04	0.03	[−0.15; −0.01]	0.15
R^2					
Communication patterns only	0.18				
Communication types and communication patterns combined[a]	0.46				

Note: $N = 32$ teams consisting of $N = 130$ participants in total. The results remain consistent when controlling for gender ratio and Dutch to non-Dutch ratio (see Appendix S2).
[a]R^2 of communication types and patterns combined was calculated by estimating a joint regression of communication types and patterns as predictors of team performance improvement. The results of this combined regression model display a similar direction of results but are not reported due to the inevitable multicollinearity of predictors.

communication patterns were found to be negatively associated with team performance improvement ($B = -0.08$, $SE = 0.04$, $p = 0.03$, 95% CI [−0.15; 0.01]), thus supporting Hypothesis 3. The effect size of this coefficient is $\eta^2 = 0.15$, indicating a large effect (Richardson 2011). Overall, these findings indicate that negative phenomena (i.e., counterproductive responses) have a stronger influence on cross-functional teams' performance improvement than positive task-oriented responses.

4.2 | Post hoc Analyses

To further clarify and enrich our main findings, we performed ancillary (post hoc) analyses to examine specific relational → counterproductive communication patterns in more depth.

4.2.1 | Analysis of Specific Verbal Codes

To further understand the relational → counterproductive communication patterns, a median split of teams was performed based on their performance improvement (i.e., the slope). Teams with a performance improvement above the median were clustered as stronger-improving teams ($n = 16$), and teams with a performance improvement below the median were clustered as weaker-improving teams ($n = 16$). Subsequently, separate sequential analyses were conducted for teams with weaker vs. stronger performance improvement. Table 6 displays the *z*-values of the transition probabilities of the respective verbal codes (i.e., the probability of relational → counterproductive communication patterns; positive *z*-values indicate an increased probability; negative *z*-values indicate a diminished probability). The results showed 10 statistically significant transition probabilities in teams with weaker performance improvement. For example, in these teams, humor is often followed by criticizing, and showing feelings is often followed by blaming. In contrast, four statistically significant transition probabilities were found in teams with stronger performance improvement. Overall, these additional analyses substantiate the findings that relational → counterproductive communication patterns are associated with weaker performance improvement in cross-functional teams.

4.2.2 | Stability of the Use of Communication Types and Patterns

To examine whether the use of the three communication types (i.e., relational, task-oriented, and counterproductive) was stable over the teams' lifecycles, a comparison was made between their frequency at t_1 and t_6. Specifically, paired *t*-tests were calculated. Results indicated no difference in relational communication between t_1 and t_6 ($\Delta M = 20.11$, $t[26] = 1.59$, $p = 0.12$), while there was more task-oriented ($\Delta M = 25.61$, $t[26] = 2.12$, $p = 0.04$) and counterproductive communication ($\Delta M = 13.43$, $t[26] = 3.93$, $p < 0.001$) at t_6 than at t_1. Concerning the relational communication patterns, no statistically significant difference was observed in relational → task-oriented communication patterns between t_1 and t_6 ($\Delta M = 5.84$, $t[26] = 1.64$, $p = 0.11$); however, there was an increase in the relational → counterproductive communication patterns at t_6 compared with t_1 ($\Delta M = 4.00$, $t[26] = 3.67$, $p = 0.001$). Figure 4 presents the results for the frequencies of the two relational communication patterns.

4.2.3 | Relationship of Performance Improvement With Post-Simulation Positive and Negative Affect

To further explore the relational dynamics taking place in the teams during TFC, positive and negative affect were measured at t_6 after the last round of the simulation ($\rho_T = 0.78$ for positive affect; $\rho_T = 0.83$ for negative affect). It was found that the team's performance improvement was negatively associated with post-simulation negative affect ($r = -0.35$, $t[30] = -2.04$, $p = 0.049$), indicating that teams with stronger performance improvement reported less negative affect after the simulation. No significant effect was observed for the relationship between performance improvement and positive affect ($r = 0.09$, $t[30] = -0.48$, $p = 0.64$). These results further support the notion that negative phenomena are particularly salient in cross-functional teams.

5 | Discussion

In this section, we interpret our key findings, consider their implications for supply chain research and practice, and point to avenues for further study. Supply chain scholars have shown

TABLE 6 | *Z*-values of relational → counterproductive communication patterns (t_1).

Responding counterproductive communication											
Initial relational communication	**Losing train of thought** z	**Criticizing** z	**Interrupting** z	**Side conversation** z	**Self-promotion** z	**No interest in change** z	**Complaining** z	**Empty talk** z	**Blaming** z	**Denying responsibility** z	**Terminating the discussion** z
Teams with weaker performance improvement											
Support	0.42 (0.34)	−0.52 (0.30)	−2.26 (0.01)	−0.05 (0.48)	0.73 (0.23)	0.08 (0.47)	0.68 (0.25)	−1.3 (0.10)	−0.43 (0.33)	−1.00 (0.16)	−0.30 (0.38)
Listening	**2.11 (0.02)**	−0.46 (0.32)	0.90 (0.18)	−2.02 (0.02)	−0.65 (0.26)	0.88 (0.19)	0.21 (0.42)	0.61 (0.27)	−0.38 (0.35)	0.34 (0.37)	−0.27 (0.39)
Feedback	**1.76 (0.04)**	−0.28 (0.39)	−0.72 (0.24)	−0.83 (0.20)	−0.40 (0.35)	−0.54 (0.30)	1.33 (0.09)	1.58 (0.06)	−0.03 (0.49)	1.35 (0.09)	−0.16 (0.44)
Opinions/facts	**1.91 (0.03)**	−0.27 (0.39)	**1.68 (0.046)**	0.02 (0.49)	**2.33 (0.01)**	−0.51 (0.31)	0.65 (0.26)	1.31 (0.10)	**4.48 (<0.001)**	1.49 (0.07)	−0.15 (0.44)
Humor	−0.42 (0.34)	**3.73 (<0.001)**	−1.30 (0.10)	0.13 (0.45)	−0.36 (0.36)	−0.49 (0.31)	−1.10 (0.14)	−0.44 (0.330)	−0.21 (0.42)	−0.49 (0.312)	−0.15 (0.44)
Reasoned disagreement	−0.39 (0.35)	−0.24 (0.40)	−0.34 (0.37)	−1.26 (0.10)	−0.33 (0.37)	−0.45 (0.24)	0.00 (0.50)	**2.38 (0.009)**	−0.19 (0.43)	**1.80 (0.04)**	−0.14 (0.44)
Encouraging	−0.24 (0.41)	−0.15 (0.44)	−0.76 (0.22)	−0.80 (0.21)	−0.21 (0.42)	−0.28 (0.39)	0.95 (0.17)	**2.05 (0.02)**	−0.12 (0.45)	−0.28 (0.39)	−0.09 (0.46)
Praise	−0.18 (0.43)	−0.11 (0.46)	−0.58 (0.28)	−0.60 (0.27)	−0.16 (0.44)	−0.22 (0.41)	−0.49 (0.31)	1.27 (0.10)	−0.09 (0.46)	−0.22 (0.41)	−0.07 (0.47)
Feelings	−0.06 (0.48)	−0.04 (0.48)	−0.20 (0.42)	−0.21 (0.42)	−0.06 (0.48)	−0.08 (0.47)	**5.81 (<0.001)**	−0.19 (0.43)	−0.03 (0.49)	−0.08 (0.47)	−0.02 (0.49)
Personal responsibility	−0.21 (0.42)	−0.13 (0.45)	−0.64 (0.26)	−0.67 (0.25)	−0.18 (0.43)	−0.24 (0.41)	−0.54 (0.30)	1.02 (0.15)	−0.10 (0.46)	−0.24 (0.41)	−0.07 (0.47)
Teams with stronger performance improvement											
Support	−0.60 (0.27)	−0.69 (0.25)	−0.43 (0.34)	−0.35 (0.36)	**2.55 (0.005)**	−0.92 (0.18)	0.83 (0.20)	1.14 (0.13)	/	−0.98 (0.16)	/
Listening	−0.03 (0.49)	−0.04 (0.48)	−1.19 (0.12)	−0.02 (0.49)	−0.04 (0.48)	−0.05 (0.48)	−0.10 (0.46)	−0.08 (0.47)	/	−0.05 (0.48)	/
Feedback	−0.22 (0.41)	−0.26 (0.40)	−0.96 (0.17)	−0.13 (0.45)	−0.26 (0.40)	−0.34 (0.37)	−0.73 (0.23)	1.10 (0.14)	/	−0.36 (0.36)	/
Opinions/facts	−0.24 (0.41)	−0.27 (0.394)	−0.02 (0.49)	−0.14 (0.44)	−0.27 (0.39)	−0.27 (0.39)	**1.83 (0.03)**	0.96 (0.017)	/	**2.27 (0.01)**	/
Humor	−0.24 (0.41)	−0.28 (0.39)	−1.06 (0.15)	−0.14 (0.44)	−0.28 (0.39)	−0.28 (0.39)	0.45 (0.33)	−0.66 (0.26)	/	−0.40 (0.35)	/
Reasoned disagreement	−0.24 (0.41)	**3.44 (<0.001)**	−1.03 (0.15)	−0.14 (0.44)	−0.27 (0.39)	−0.27 (0.39)	−0.79 (0.22)	−0.64 (0.26)	/	−0.39 (0.35)	/
Encouraging	−0.13 (0.45)	−0.15 (0.44)	−0.58 (0.28)	−0.08 (0.49)	−0.15 (0.44)	−0.15 (0.44)	−0.44 (0.33)	−0.36 (0.36)	/	−0.22 (0.41)	/
Praise	−0.09 (0.46)	−0.10 (0.46)	−0.37 (0.36)	−0.05 (0.48)	−0.10 (0.46)	−0.10 (0.46)	−0.29 (0.39)	−0.23 (0.41)	/	−0.14 (0.44)	/
Feelings	−0.05 (0.48)	−0.06 (0.48)	−0.21 (0.42)	−0.03 (0.49)	−0.06 (0.48)	−0.06 (0.48)	−0.16 (0.44)	−0.13 (0.45)	/	−0.08 (0.47)	/
Personal responsibility	−0.14 (0.44)	−0.16 (0.44)	−0.62 (0.27)	−0.08 (0.47)	−0.16 (0.44)	−0.16 (0.44)	−0.47 (0.32)	−0.39 (0.35)	/	−0.23 (0.41)	/

Note: Presented above are the *z*-values of expected transition probabilities of patterns of relational communication (initial), followed by counterproductive communication (responding) in weaker- vs. stronger-improving teams. *p*-values are provided in parentheses. Upper-tailed significant *z*-values are printed in bold. Slashes indicate that responding communication did not occur in this group.

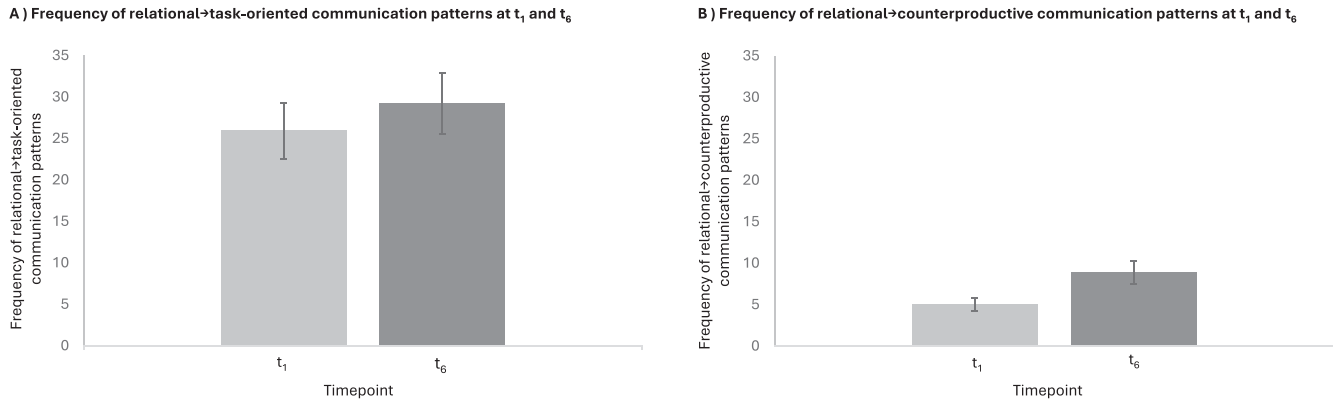

FIGURE 4 | Stability of frequencies of communication patterns from t_1 to t_6. [Colour figure can be viewed at wileyonlinelibrary.com]

growing interest in the human elements of cross-functional teams (e.g., de Vries et al. 2022; Kaufmann and Wagner 2017). Motivated by preliminary insights into the role of communication in these teams (Lu, Kaufmann, and Carter 2021; Montoya, Massey, and Lockwood 2011; Schmidt, Montoya-Weiss, and Massey 2001), this article builds upon interactional ritual theory to explain how communication patterns contribute to a more nuanced understanding of team processes and dynamics that shape team performance. First, we found that a higher frequency of relational communication was negatively associated with performance improvement. Because the simulation used, in line with the team learning principles (de Leeuw, Schippers, and Hoogervorst 2015; Marks, Mathieu, and Zaccaro 2001), is designed as a learning task, team performance improvements are generally expected. Therefore, a weaker improvement reflects a suboptimal team outcome. This finding, which highlights the detrimental role of the mere frequency of relational communication, is somewhat counterintuitive. However, interpreting frequency alone is not fully meaningful; communication is better understood through interactional flow (Lehmann-Willenbrock 2025), such as communication patterns. In this regard, counterproductive communication was found to be less frequently used than task-oriented communication in response to relational communication across all meetings. Still, in line with this article's theoretical predictions, the results suggest that relational → counterproductive communication patterns are negatively correlated with teams' subsequent performance improvement.

This negative implication of counterproductive response was widely mirrored by participants in an ad hoc qualitative study,[4] as exemplified by Participant #9, who stated, "there would likely be large communication breakdown that would result in work not being completed in a timely, accurate, or effective way." A similar sentiment was shared by Participant #14: "From that point on, we struggled to make joint decisions and felt there was a lot of tit for tat going on ... There was a lot of wasted time and individuals not wanting to support each other's ideas or to give constructive feedback. We achieved very little that we hoped to."

Further, relational → task-oriented communication patterns in the first cross-functional team meeting did not statistically significantly (instead of positively) influence subsequent team performance. A potential theoretical explanation for the latter somewhat surprising findings involves the negativity effect. This principle suggests that negative information carries more weight than positive information in shaping evaluations and outcomes (Baumeister et al. 2001; Peeters and Czapinski 1990). Specifically, negative information (i.e., a counterproductive response) tends to be processed more thoroughly than positive information (i.e., a task-oriented response) and more profoundly influences final evaluation and subsequent behavior. This ties in with the ancillary analysis, which found that counterproductive responses to relational communication were associated with increased negative affect after the simulation. In line with this reasoning, Lu, Kaufmann, and Carter (2021) demonstrate that in cross-functional sourcing teams, advice rejection (acceptance) in informal encounters reduced (increased) an advisor's willingness to provide future advice to the advice-receiving supply manager, with the negative effect of rejection outweighing the positive impact of advice acceptance.

Reflecting on the presence of negativity bias, Participant #7 illustrated how the consequence of a counterproductive response could spread from one specific team member to the wider team, noting, "It made me sour against him for a while, and I could tell others acted colder to him as well." Participant #13, on the other hand, remarked about the long-lasting impact of such consequence, sharing, "The team always appeared a little frosty and cold with each other during following meetings and never appeared to be able to agree on numerous matters." In terms of patterns where relational communication is followed by task-oriented responses, most supply chain professionals in the ad hoc qualitative study viewed it as typical in cross-functional teamwork, thus having no discernable impact on performance. This neutral perspective is exemplified by Participant #5, who noted, "Everyone is singing from the same hymn sheet, so these sort[s] of communications don't have a meaningful impact above and beyond the performance levels that are already expected."

5.1 | Theoretical Implications

This article contributes to the supply chain literature in several ways. First, it challenges the prevailing conceptualization of team processes and dynamics in cross-functional teams. Specifically, this article adopts a micro-level lens on interaction rituals in the form of communication patterns. Examining these patterns shifts

away from conventional, dominant broad evaluations of team communication (e.g., frequent vs. rare) (Bruccoleri, Riccobono, and Größler 2019; Driedonks, Gevers, and Weele 2010; Malhotra, Ahire, and Shang 2017). This approach allows for specific implications, such as mitigating detrimental patterns that harm team performance improvement (i.e., relational → counterproductive communication patterns) and replacing them with more functional communication patterns (relational → task-oriented communication patterns). Such nuanced insights go beyond general advocacy for "open" or "frequent" communication as universally effective (e.g., Driedonks, Gevers, and Weele 2010; Sanderson, Esfahbodi, and Lonsdale 2022). Additionally, by emphasizing the central role of team processes and dynamics through the lens of communication patterns, this work extends prior literature that predominantly focuses on team characteristics (e.g., emotional intelligence) and emergent states (e.g., goal alignment) in cross-functional teams (Franke and Foerstl 2020; Kaufmann and Wagner 2017).

Second, this article contributes to the ongoing discussion about the interplay between relational and task-focused processes in cross-functional teams (Bruccoleri, Riccobono, and Größler 2019; Lonsdale, Sanderson, and Esfahbodi 2024). While prior work has established that formal, task-oriented aspects of teamwork, such as decision-making or knowledge creation (Arumugam, Antony, and Kumar 2013; de Vries et al. 2022), are vital for team success, this article challenges this consensus by shifting attention to the relational processes that underpin team dynamics (Bruccoleri, Riccobono, and Größler 2019; Gifford et al. 2022; Kaufmann and Wagner 2017). The rather lopsided focus on the task domain in previous work is particularly surprising, considering that earlier studies recognized the unique challenges that cross-functional teams face in maintaining well-functioning relationships, given team members' diverse backgrounds and potentially conflicting goals (Driedonks, Gevers, and van Weele 2014; Kaufmann and Wagner 2017). This article reveals that responding to relational communication with task-oriented communication (e.g., suggesting a solution to a problem as a response to a team member's encouragement) could mitigate detrimental effects on cross-functional team performance. By investigating this interplay, this article extends the ongoing conversation beyond the relational versus task orientation dichotomy, emphasizing the need to understand how both domains interweave to enhance cross-functional team effectiveness.

Third, this article introduces interaction ritual theory (Collins 2005) to the supply chain management field, providing a novel perspective on cross-functional team processes and dynamics by emphasizing the temporal elements of communication patterns. While the importance of temporal dynamics is well established in the broader team literature (e.g., Lehmann-Willenbrock 2025), this article adds to supply chain literature by demonstrating how communication patterns unfold over time within cross-functional teams. Specifically, it shows that relational communication can influence team performance improvement differently, depending on whether it is followed by task-oriented or counterproductive communication. These findings underscore the importance of considering not only the frequency of communication but also the sequence of interactions. This perspective aligns with emerging supply chain research that addresses temporal elements, such as Lu, Kaufmann, and Carter (2021), who examined how prior advice exchanges shape later collaboration in cross-functional sourcing teams. Methodologically, this article showcases a novel coding approach that captures how communication unfolds over time within cross-functional teams. By systematically analyzing real-time communication, we deepen our understanding of how cross-functional teams function and offer supply chain scholars a new methodological toolkit for studying team dynamics.

5.2 | Practical Implications

This article has several implications for supply chain practitioners. First, it highlights the need to examine interactions within cross-functional team meetings to understand what makes teams successful, rather than focusing solely on team composition (Randel and Jaussi 2003). More specifically, the empirical findings can serve as a basis for sensitizing supply chain managers to the value of relational matters in early team meetings, as these seemingly "soft" factors are influential for "hard" outcomes, such as a team's ROI.

The findings can inform the design of tailored training programs for cross-functional teams, equipping team members with knowledge and awareness of specific communication patterns to avoid or cultivate. Such training could be crucial for fostering positive, effective communication and improving mutual understanding within teams. Specifically, team members should deliberately practice and reflect on their communication patterns within a safe environment, such as a business simulation, under the guidance of an experienced communication trainer. For example, the trainer could use the DESC (describe, express, specify, consequence) conflict resolution tool, which is commonly applied in cross-functional medical teams (Deering, Johnston, and Colacchio 2011).

Additionally, the findings illustrate that initial interactions within cross-functional teams could set the trajectory for future team performance improvement. Recognizing that these interactions can often be stressful due to tight deadlines (as is often the case in daily operational business, Keller 2001), it could be valuable to schedule informal pre-project launch meetings. These meetings can help establish functional communication patterns in a lower-pressure setting, allowing teams to engage without immediate pressure to deliver results. To maximize their effectiveness, these pre-project launch meetings shall be designed in a participatory way, following evidence-based recommendations for preparing, conducting, and following up on effective meetings (for more details, see Lehmann-Willenbrock and Allen 2018 and Mroz et al. 2018).

5.3 | Societal Implications

This article also offers several societal implications. It deepens the understanding of interpersonal and relational phenomena in supply chain management practices. Specifically, the findings highlight the importance of functional and respectful communication for the long-term success of cross-functional

teams. By suggesting concrete communication patterns to encourage or avoid in such teams, this article makes a small yet meaningful contribution to supporting the sustainable development goal of decent work and economic growth (UN General Assembly 2015).

Furthermore, this article offers insights into successful cross-functional collaboration beyond the private sector. For instance, cross-functional collaboration is also essential in the public sector, particularly in change management within local political authorities (Piercy, Phillips, and Lewis 2013). Hence, the findings and recommendations regarding specific communication practices in cross-functional teams may also be adapted to the political context. This could help shift from rigid top-down policy-making to more decentralized decision-making, thereby overcoming institutional silos (Piercy, Phillips, and Lewis 2013).

5.4 | Limitations and Future Research

The article has several limitations that provide avenues for future research. First, the simulation setting offers key advantages over purely experimental methods—for instance, it more realistically represents cross-functional teamwork and largely minimizes the concerns about demand effects. However, it also limits the ability to make causal claims, so future research could investigate experimental or quasi-experimental approaches, building on these findings. For instance, scholars could randomly assign newly formed cross-functional teams to training designed to enhance awareness of how to respond to relational communication with task-oriented rather than counterproductive communication. A control group of teams would engage in teamwork without such an intervention (but would, of course, receive the training afterward).

Second, the cross-functional teams in the simulation were purposefully structured to ensure that the team members had no prior formal collaboration. However, it cannot be ruled out that some team members engaged in informal interactions. Although such informally gained familiarity may also be present in cross-functional teams in a real-life setting, preliminary evidence shows that informal interactions can impact cross-functional sourcing collaboration (Lu, Kaufmann, and Carter 2021). Meta-analytic findings further indicate that the link between communication and performance becomes stronger with increasing team familiarity, as team members communicate more effectively (Marlow et al. 2018). Contrarily, Frasier et al. (2019) show that familiarity does not necessarily correlate with the frequency or effectiveness of communication. Oliveira, Argyres, and Lumineau (2022) also make the case that relational contracting (i.e., trust based on previous relationships) is less critical for team effectiveness than actual communication in addressing interorganizational project disruptions.

Future research could thus extend the present study by explicitly investigating cross-functional teams with varying levels of familiarity among team members and exploring how team familiarity interacts with communication patterns to affect team performance. On the one hand, in line with meta-analytical findings (Marlow et al. 2018), teams with higher familiarity may exhibit a stronger positive (rather than neutral) association between relational → task-oriented communication patterns and team performance improvement. On the other hand, the negative relation between relational → counterproductive communication patterns and performance improvement may likewise be more pronounced in more familiar teams. This is because team members may attribute more value to counterproductive responses if they are more familiar with the individuals involved (Xie et al. 2020).

In a similar vein, one could argue that teams engaging in a supply chain management simulation may differ from cross-functional teams in real organizational contexts, where members bring diverse skills and knowledge gained from years of experience. While this distinction may be true, it does not necessarily limit the generalizability of the findings. Specifically, in real-world contexts, team members can be more strongly imprinted by their functional backgrounds, making them more prone to conflict and counterproductive communication (Boroş et al. 2017; Majchrzak, More, and Faraj 2012). Therefore, the identification of detrimental communication patterns in the "light touch" simulation underscores the need to remain alert to even subtle signs of negative phenomena, such as counterproductive communication, in cross-functional teams.

Third, in addition to team familiarity and job-specific knowledge, the findings may also be influenced by individual teamwork competencies, that is, the ability to interact and cooperate with others (e.g., conflict resolution and task coordination; Aguado et al. 2014). While it was assumed that the (pseudo-)random allocation of team members would lead to an equal distribution of teamwork competencies across teams, potential biases could not be entirely ruled out. Therefore, future research on team processes and dynamics in cross-functional teams should specifically assess members' teamwork competencies as a potential third variable that influences both communication (patterns) and supply chain performance (Fernando and Wulansari 2021).

Fourth, this research did not capture all possible communication patterns that might occur in cross-functional teams. For example, relational → relational communication patterns were not explicitly considered due to methodological considerations about overlaps when including this pattern in the model.[5] From a theoretical standpoint, excessive use of relational → relational communication patterns may have a detrimental effect on team performance improvement, as it could detract from essential task-related discussion (Eldor, Hodor, and Cappelli 2023; van Dun and Wilderom 2021). Further, the focus on relational communication patterns was motivated by the burgeoning interest in the relational side of team processes and dynamics in supply chain management (Lu, Kaufmann, and Carter 2021) and the limited empirical insights into the effects of relational communication on team effectiveness (Kauffeld and Lehmann-Willenbrock 2012). Future research could expand the findings of this article by exploring patterns that start with task-oriented or counterproductive communication.

Finally, this research expects teams to improve their performance over time, in line with general team learning principles

(de Leeuw, Schippers, and Hoogervorst 2015; Marks, Mathieu, and Zaccaro 2001). However, this may not hold true for all types of cross-functional teams or situations in supply chain management. For example, time-sensitive circumstances, such as when teams need to initiate a mitigation plan under tight deadlines (Macdonald and Corsi 2013), may fall outside the scope of this research, which focuses on team learning and performance improvement over time. Future studies could explore how communication dynamics unfold in teams where the goal is to achieve immediate results rather than sustained performance improvements.

6 | Conclusions

This research advances our understanding of cross-functional teams by examining how the temporal and interactional complexities of communication affect team performance. Focusing on clear, constructive communication can help cross-functional teams avoid performance setbacks and offer new pathways for research into improving team dynamics. Methodologically, this study demonstrates that employing an interaction coding approach can not only effectively capture actual communication interactions but also provide a promising approach to uncovering the dynamic nature of team processes. This novel methodological approach can enrich the repertoire of supply chain management research and open promising avenues for future studies on cross-functional teams.

In an era of unprecedented supply chain pressures fueled by global crises or rapid technological advancement, optimizing cross-functional team dynamics is more critical than ever. Members' diverse expertise and perspectives constitute the greatest strength of cross-functional supply chain teams, but they also make these teams particularly susceptible to communication breakdowns. To tackle this challenge, our research points to a deeper understanding of relational communication—how team members convey and respond to interpersonal signals—and its profound impact on supply chain performance. By addressing these relational communication dynamics, organizations can better harness the potential of cross-functional teams, ensuring that they remain resilient and effective in navigating the uncertainties and demands of modern supply chains.

Endnotes

[1] In an earlier version of this research, we included an additional competing hypothesis ($H2_{competing}$) that proposed a non-significant relationship between patterns of relational communication followed by task-oriented communication on performance improvement. Based on reviewer comments and to strengthen our conceptual grounding, we decided to remove this competing hypothesis.

[2] While this study specifically focused on verbal behavior, non- or paraverbal behaviors were also partially considered in those cases where the mere verbal behaviors were inconclusive or did not fully represent the content conveyed by the speaker. For example, when identifying relational behaviors of active listening, non-verbal cues like nodding and eye contact were used to adequately code the behavior.

[3] See the link to our aggregated data and analysis code: https://osf.io/jgk7n/

[4] We conducted an ad hoc qualitative study with 19 supply chain professionals (see Appendix S6 for the demographic details of the participants). The methodological approach and detailed results are available from the authors upon request.

[5] Analyses of the association of relational → relational communication patterns on team performance improvement are available from the authors upon request.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.