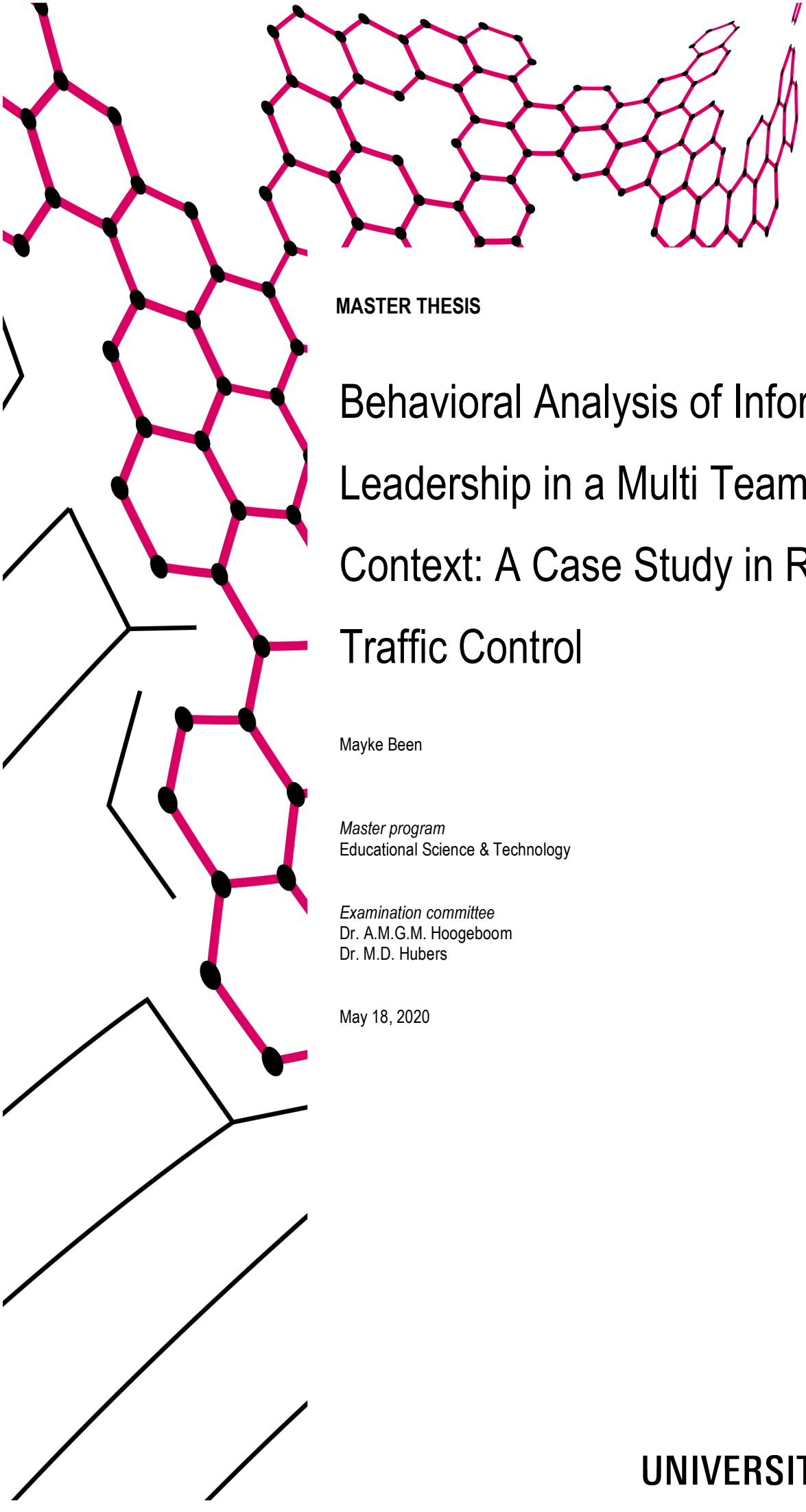

MASTER THESIS

Behavioral Analysis of Informal Leadership in a Multi Team System Context: A Case Study in Railway Traffic Control

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Abstract

To serve increasing challenging work demands, organizations are leaning progressively towards organizational systems comprised of teams, which are more and more organized as a Multi Team System (MTS), nowadays. MTSs are a relatively new way of organizing work to achieve goals too ambitious and extensive to be handled by a single team, by joining forces with multiple specialized teams in the system. Leadership is proven to play a key role in MTS success, more specifically informal leadership seems to be effective for MTSs. However, research on informal leadership in an MTS is focused on MTS processes or the MTS as a whole, while behavioral information could be of great value to practice. With gaining insights in this area on a detailed behavioral level, this study aims at contributing to future research and ultimately the optimization of informal leadership behavior in MTS contexts.

To do so, a taxonomy for leader behavior (i.e. codebook) has been developed with insights from multiple leadership and behavioral taxonomies and team communication literature. The behaviors of a whole MTS have been minutely video-observed, in a case study with a routine and non-routine task context. As a reference for the behavior of the informal leader, the behaviors of all the members in the MTS have been observed. In this case study, these members are all boundary spanners. Next, the three most occurring behaviors are being discussed in detail; informing, clarifying, and delegating. The difference in behavior between the informal leader and the boundary spanners, is the intention with which they execute the behavior. The informal leader actively spreads information and passively acquires information. The boundary spanner performs this behavior actively and distributes acquired information within their team. The informal leader takes decisions and communicates these and the boundary spanners leave the decision-making for the informal leader. In other words, results suggest that although the observed organization applies a horizontal hierarchy, the practice seems to show a more traditional hierarchy around the informal leader, which is more prominent in the routine task context than in the non-routine task context.

These findings have implications for future research in informal leadership behavior because it implies that task context could influence behavior performed in a group. Furthermore, it adds to our knowledge on MTS in general and to knowledge on the roles of informal leaders and boundary spanners on a micro-behavioral level.

Keywords Informal leadership, Multi Team System, boundary spanning, video-based observation, task context

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Introduction

Over the past decades, a trend is visible of more and more organizations structuring work by using a multiple team structure. In literature, this resulted in the development of a new organizational concept, namely 'Multi Team Systems' (MTSs). MTSs are organizational systems consisting of two or more teams, which are interdependent and closely linked to achieve collective goals (Mathieu, Marks & Zaccaro, 2001). They exist to achieve goals too ambitious and extensive to be handled by a single team, by joining forces (i.e. specialisms) with multiple teams in the system (Zaccaro & DeChurch, 2012). They are different from traditional work teams because cooperation must also occur across teams to be successful, which brings new challenges (Salas, Reyes & McDaniel, 2018).

Because of the rise in organizations adopting this new organizational form, we want to understand how MTSs work. Recent studies have started exploring a range of topics in an MTS context, such as psychological safety, social identity, conflicts, adaptation, leadership, transactive memory, goal attainment, and team satisfaction. Nevertheless, recent literature points out that literature on MTS is still in its infancy (e.g., Landon, Slack & Barrett, 2018; Ervin, Kahn, Cohen & Weingart, 2018; Fiscella & McDaniel, 2018; Power, 2018). So, although some topics have been addressed before, there is still much to be learned about MTSs to fully understand the exact operation of this relatively new concept (Salas et al., 2018).

In an MTS, but also in regular work teams, leadership has been proven to be pivotal when it comes to team effectiveness (e.g. Zaccaro, Rittman, & Marks, 2001; Zaccaro and DeChurch, 2012; Yukl, 2012; Marks, DeChurch, Mathieu, Panzer & Alonso, 2005; DeChurch and Marks, 2006; DeChurch et al. 2011; Bienefeld & Grote, 2014). Therefore, this study follows the idea that it is important to study this specific topic, to extend our knowledge of how leadership takes place in an MTS context and to gain valuable insights which could enlarge the effectiveness of these systems in the future.

Yet, most studies that examined leadership in an MTS context approached a leadership role as it is embodied by an authorized individual, so-called formal leadership (Shuffler et al., 2015). However, practice shows that, in MTSs, more often informal leadership takes place. Moreover, informal leadership is likely to be more effective for systems such as MTSs (Cox et al., 2003; Zaccaro & DeChurch, 2012). Informal leadership is the phenomenon of an employee not in an official leadership position but recognized as a leader nevertheless (Pielstick, 2000).

With this knowledge in mind, researchers have suggested exploring how informal leadership works in an MTS (e.g. Davison, Hollenbeck, Barnes, Sleesman & Ilgen, 2012;

Fleştea, Fodor, Curşeu & Miclea, 2017). Remarkably, an exact examination of behavior performed by the informal leader in an MTS context is rarely done, while this could enhance our understanding of how informal leadership takes place in an MTS context over time. Finally, it could provide valuable knowledge for practice in terms of effective informal leadership application.

Studying this topic, it has to be taken in mind that task context could influence the behavior displayed by the informal leader. When teams work on a task, task context could influence the behavior that is being performed in different situations (Kerr, 2017). So, it is important to take into account this context when trying to better understand the behavior of an informal leader. Therefore, this study will differentiate task context in a way that, according to literature, it is likely to affect the behavior displayed in an organizational system. In short, this study will analyze the behaviors of the aforementioned roles in a routine and a non-routine situation. Based on the above the following research question and sub research question have been formulated:

How does an informal leader behave in an MTS context?

- *To what extent does informal leader behavior differ in a non-routine task context versus a routine task context?*

To observe the behaviors of the informal leaders and boundary spanners in an MTS context, a taxonomy for leader behavior (i.e. codebook) has been developed with insights from multiple leadership and behavioral taxonomies and team communication literature, to make sure that the full range of leader behavior is taken into account.

With this, the study contributes to the literature in three ways. In the first place, this study contributes to both the MTS and leadership literature, because the current study sheds more light on the role of informal leadership and therefore provides an answer to the repeated call for research into informal leadership in an MTS context (e.g. Burke, DiazGranados & Salas, 2011; Fleştea et al., 2017).

Secondly, this study takes a very precise behavioral approach to analyze informal leadership behavior and behavior displayed by boundary spanners, where previous studies researched MTS processes or the MTS as a whole (Davison et al., 2012). With this approach, this study is one of the first to paint a detailed picture of behavior by an informal leader in an MTS context.

Third, this research makes the distinction in routine versus non-routine task context, which has not been done before in MTS research. Thus, results will concretize whether this task context plays a role in behavior performed in an MTS. If so, this study could provide valuable insights for future research into MTS contexts.

Theoretical framework

Multi Team Systems

To serve increasing challenging work demands, organizations are leaning progressively towards organizational systems comprised of teams, which are more and more organized as a Multi Team System (MTS), nowadays (Shuffler & Carter, 2018). These are two or more teams, which are interdependent and closely linked to achieve collective goals, apart from their own proximal goals (Mathieu et al., 2001). These shared goals are often too ambitious and extensive to be handled by a single team, but can by joining forces with multiple teams in the systemfor instance, by combining knowledge of different specialized teams (Zaccaro & DeChurch, 2012). Organizations do so more frequently, to accomplish multidisciplinary tasks in contemporary complex environments more effectively (Marks et al., 2005). Scientific research recognized this trend towards work being more and more organized in MTSs. Instead of only looking at one team structures, more scientific work is focused on inter-team processes in an MTS context (Shuffler, Jiménez-Rodríguez & Kramer, 2015). By doing so, these studies come much closer to how work is being accomplished in organizations nowadays.

The MTS context can particularly be recognized in organizations that work on a national scale, because of the size of the organization, it is most likely organized in an MTS (Davison et al., 2012). This is also reflected in the numerous studies in contexts such as (air) traffic control (e.g. Vessey, 2014; Goodwin, Essens, and Smith, 2012; Bienefeld & Grote, 2014; Schipper, 2017), the military, army and air force (e.g. DeCostanza, DiRosa, Jiménez-Rodríguez, & Cianciolo; de Vries, Walter, van der Vegt & Essens, 2014; Firth, Hollenbeck, Miles, Ilgen, & Barnes, 2014). As an example: the army works in different troupes from the air, land, and marine. They all have their own proximal goals, but the only way to beat their opponent is by combining knowledge and forces. Thus, for the whole system to be successful, they are interdependent in their actions. In other words, one team being successful does not make the system as a whole successful. Next to the aforementioned examples, also other organizations frequently organize work in an MTS, such as organizations in the governmental, private, and public sectors (DeChurch et al, 2011).

Several researchers claim that literature on MTS is still in its infancy (e.g., Landon et al., 2018; Ervin et al., 2018; Fiscella & McDaniel, 2018; Power, 2018). This implies that concepts in MTS research remain (barely) untouched and further research is required to deepen our knowledge on MTS. Current studies into the MTS context, focus on what processes are pivotal for MTS performance and effectiveness (e.g. Healey, Hodgkinson & Teo, 2009; Fodor & Flestea, 2016). The studies show that behavioral processes such as leadership, communication, and coordination are prerequisites for high MTS performance (Shuffler et al., 2015). This study will focus on the pivotal process of leadership and thereby deepen our knowledge on this specific process within an MTS context.

The role of leadership in an MTS context

As described before, teams within an MTS interdependently work towards at least one collective goal. Because of this interdependence in achieving that goal, teamwork across teams becomes even more important than it already is in traditional organizations (Salas, Reyes & McDaniel, 2018). For teamwork across teams to be successful, coordination seems to be one of the main ingredients (de Vries, Hollenbeck, Davison, Walter & van der Vegt, 2016). Researchers suggest that the leader is ideally suited to take on this coordinating role (e.g. Davison et al, 2012; Wijnmaalen, Voordijk & Rietjens, 2017). They state that MTS effective leaders must be able to align teams within the system with a focus on the reciprocal interdependence across teams in the context of performance and environmental demands (Marks, DeChurch, Mathieu, Panzer, & Alonso, 2005) In other words, leaders need to fulfill a coordinating role and perform behavior that enhances inter-team cooperation (DeChurch et al., 2011; Zaccaro & DeChurch, 2012). However, knowledge of how this is done exactly or should be done is developing.

Informal leadership

In MTS literature, similar to ‘traditional’ team leadership literature, research into forms of informal leadership is gaining ground (Burke et al., 2011). Pielstick (2000) defines informal leadership as ‘those not in positions of leadership but recognized as leaders nevertheless’. Thus, despite the absence of a formal leader, informal leadership can take place.

Recent studies have theorized and shown that forms of informal leadership are more suitable to an MTS context than formal leadership and increases team goal attainment and MTS success (e.g. Zaccaro, Marks & DeChurch, 2012; Bienefeld & Grote, 2014). This is an eminent

result of the fact that interdependence in goal achievement, which is one of the main characteristics of MTSs, increases the chance of the appearance of informal leadership (Cox et al., 2003; Zaccaro & DeChurch, 2012). In addition, Cox et al. (2003) even establishe that informal leadership is more effective when there is high interdependence in a system, as it requires higher levels of coordination and information exchange. He explains this with the following arguments; first, in such systems, it is unlikely that one individual has all the expertise needed throughout the whole process, therefore a rotation of leadership or shared leadership is most likely to be more effective than formal leadership. Furthermore, coordination requires a leader on multiple positions in the system at different times, therefore is informal leadership also more likely to be effective in a high interdependent system than formal leadership. Thus, informal leadership is not only more likely to appear in MTSs than in regular work systems but probably also more effective in MTSs. Therefore, insights in how informal leadership takes place in an MTS could be valuable knowledge in de growing literature about MTSs.

More specifically, this study will take a look at informal leadership at a behavioral level. From the information above, we know that informal leadership is more likely to appear in an MTS than in other work systems and probably more effective in an MTS than formal leadership. However, this knowledge stays rather superficial. Indications of informal leadership on a behavioral level in an MTS seem to be scarce, while this information could be of great value as a starting point for future research and ultimately the optimization of informal leadership behavior in MTS contexts. Therefore, this study takes a structured explorative approach and aims at gaining insights into informal leader behavior on a detailed level.

Examining informal leader behavior in an MTS context

The way leadership takes place is reflected in the behaviors a leader shows (Yukl, 2012). In leadership research, most of the time a survey method like approach has been deployed to observe behavior performed by a leader (Bass & Bass, 2008). However, this sketches a perceived picture of a leader instead of an objective one and has led to conclusions that were on a macro-level, such as general leadership styles, but not a fine-grained description of (effective) leadership behavior (Lehmann-Willenbrock & Allen, 2018; Behrendt Matz and Göritz, 2017). Therefore, researchers voiced the need to explore informal leadership in an MTS context on a behavioral level (e.g. Davison et al., 2012; Fleştea et al., 2017; Wijnmaalen et al., 2017). This study follows the idea that to gain insight in informal leadership taking place in an MTS context, actual behavior by MTS members should be observed, so taking a micro-

behavioral approach (e.g. Davison et al., 2012; Kauffeld & Lehmann-Willenbrock, 2012; Behrendt, Matz & Göritz, 2017).

To gain a complete view of informal leader behavior in an MTS, a broad range of behaviors will be studied. A new taxonomy (i.e. codebook) has been developed with knowledge on leadership from different research fields. The developed taxonomy can be found in appendix A. The following text will explicate the scientific background of this taxonomy.

A taxonomy that is widely accepted, and has continuously been the foundation of numerous studies on leadership and management, is the one developed by Yukl (2012) (e.g. Mitchel & Bommer, 2018; Walter, Cole, van der Vegt, Rubin & Bommer, 2012; Zhang, Waldman, & Wang, 2012). Yukl (2012) developed four behavioral categories (i.e. task-, relations-, action- and change-oriented behavior), specified into behaviors. All different behavioral meta-categories have their objectives. For example, the objective of task-oriented behaviors is to manage work in such a way that it is executed in the most effective and reliant way (Yukl, 2012). All behaviors in the concerned meta-categories comply with their objectives.

Although its popularity, the taxonomy by Yukl (2012) received some criticism, which resulted in numerous adjusted taxonomies, all from different perspectives depending on the field of research, with insights from different leadership models. For example, Behrendt et al. (2016) stated that Yukl (2012) did not take into account observation biases and behavior perception. Therefore, they modified Yukl's (2012) taxonomy, building on integrated research bodies from the field of psychology. Moreover, Hoogeboom & Wilderom (2019) updated the taxonomy of Yukl (2012) by adding a less studied behavioral category, namely counter-productive leader behavior. Some researchers have developed more detailed descriptions of the task- and relations-oriented behaviors (e.g. Hoogeboom & Wilderom, 2019), whereas others combine behaviors into broader behavioral categories (e.g. Behrendt et al., 2016**)** or created new meta categories (i.e. procedural behavior and action-oriented behavior: Meinecke, Lehmann-Willenbrock & Kaufeld, 2017**)**.

The current study draws upon the specific classification of Yukl (2012) but combines this knowledge with the aforementioned and other improved taxonomies based upon this classification and also other models of leadership behavior (e.g. Bass, 1985). This has been done by comparing the micro-behaviors of all taxonomies with the classification of Yukl (2012) as a starting point. Then, behaviors have been added or specified and/or split into and replaced by more specific behaviors to make the behaviors mutually exclusive and comprehensive[1]. The

[1] Yukl (2012) also includes the meta-category external behavior. Its objective is 'to acquire necessary information and resources, and to promote and defend the interests of the team or organization'. This includes

added behaviors in the different meta-categories were categorized as such because they comply with the objectives as described by Yukl (2012). For example, the added behaviors in the meta-category 'task-oriented behavior' were regarded as task-oriented behavior, because they were all behaviors that catalyze the process of task execution. Moreover, they were classified as such in the study of origin. At last, Meinecke et al. (2017) introduced two new meta-categories, namely action-oriented behavior and procedural oriented behavior. Three behaviors in these categories were behaviors that were not addressed in the taxonomy of Yukl (2012). These behaviors are negative counteractive behavior, negative procedural behavior, and positive procedural behavior (Bienefeld & Grote, 2014; Meinecke et al., 2017; Hoogeboom & Wilderom, 2019). Because they did not match the objectives of the task-, relations- or change-oriented behavior meta-categories, they were added in our taxonomy with the meta-category categorization set by the studies of origin[2].

Behaviors of informal leaders in an MTS

Combining the behaviors from the taxonomy with informal leadership, some expectations can be formulated. From leadership literature, we know that (effective) leadership consists of task- and relation-type behaviors (Hoogeboom & Wilderom, 2015). In an MTS context, the expectation is that because of the high pressure and often ad hoc nature of situations MTSs have to deal with (DeChurch et al, 2011), the informal leader will mostly show task-oriented behavior to complete tasks (House, 1971). With the reason that, in such situations, there is only time for the bare essentials in reaching the goal. These could be, in addition to the behavior of gathering, filtering, and distributing information (i.e. informing and clarifying) (Davison & Hollenbeck, 2011), task-oriented behaviors such as monitoring, problem-solving and delegating.

Furthermore, as described before, coordination is an important aspect in MTSs and the informal leader could play a valuable part in the process of coordination (Wijnmalen et al., 2017). For the informal leader to enhance coordination processes, he/she could show behaviors that ensure sufficient trust among MTS team members to share information and cooperation, and a boundary spanning attitude to monitor MTS alignment, which could ensure that possible

behaviors such as networking, external monitoring, and representing. This meta-category was not included in the other taxonomies. Moreover, in this case study, these behaviors were assessed as inapplicable and therefore not represented in the taxonomy.

[2] For a detailed explanation on the behaviors that have been added or specified and/or split into and replaced by more specific behaviors, see appendix C.

causes of conflict could be overcome (Davison et al., 2012; Fodor and Flestea, 2016). To create mutual trust, the informal leader could perform relation-oriented behavior (e.g. mental support, recognizing, and empowering intellectual stimulation) (Edmondson, 2014).

The role of informal leaders versus the role of boundary spanners in an MTS

To be able to clarify how an informal leader behaves in an MTS context, we take a balanced approach; this study will observe all members in an MTS, of which one is taking on the role of an informal leader. After observing, the informal leader will be identified. All observed employees have a similar hierarchical position and have equal power to make decisions that affect the MTS as a whole. In this case study, these are all 'boundary spanners'. Boundary spanners link the internal network to sources of information in the external environment (Tushman, 1977). In MTSs, these sources of information are often other teams in the system. In short, by comparing the behavior of the informal leader to the behavior from the other MTS members as a reference, this study aims at gaining insight into the behavior displayed by an MTS member in an informal leader role.

For boundary spanners to be contributing to team goal attainment and MTS success, they should be gathering, filtering, and distributing information internally in their team and externally to the other teams (Davison & Hollenbeck, 2011). Effective coordination and communication of this information by the boundary spanners can enhance MTS effectiveness (Bienefeld & Grote, 2014; Marks et al, 2005). Therefore, the expectation is that the boundary spanners will predominantly show informing and clarifying behavior to manage the flow of information in the MTS.

Furthermore, the expectation is that although the ad hoc situation the boundary spanners will show behavior that is not directly essential for task execution, such as relational behavior, as the boundary spanners may not feel the same pressure and urge of only showing task performed behavior as the informal leader at moments that they are not central in the task execution.

In conclusion, the expectation is that both the informal leader and boundary spanners will predominantly show clarifying and informing behavior (e.g. Davidson & Hollenbeck, 2011). We expect to see differences in the relational behaviors, as we expect the informal leader to focus solely on task execution, while the boundary spanners will experience moments of relief when the focus is on another team and thus have room for relational behavior (House, 1971).

Based on the above, the following research question will be addressed:

How does an informal leader behave in an MTS context?

- *How is this different from the behavior that a boundary spanner shows in this context?*

Similar to many studies in the field of social science, the expectations in behavior could be influenced by several factors. For example, when teams work on a task, task context could influence the behavior that is being performed in different situations (Kerr, 2017). So, it is important to take into account this context when trying to better understand the behavior of an informal leader, as it might be that the task context influences the behavior displayed by the informal leader.

Routine and non-routine task context

In general, MTSs are designed to deal with non-routine situations, such as in health care emergency (DeChurch et al., 2012; DeChurch et al, 2011). However, some MTSs deal with both routine and non-routine situations, such as in railway traffic control (e.g. Schipper, 2017). The distinction of a routine and non-routine task context has not been made before in MTS literature, although researchers such as Kerr (2017) advocated for more research taking into account the role of the group's task on group behavior. A distinction in task context that can be made is whether the task is routine or non-routine in nature (Kerr, 2017). Routine work includes 'standard operating procedures' to create consistency in delivered work (Lei, Waller, Hagen & Kaplan, 2016). While non-routine work is characterized by unpredictability, rarity, time pressure, and complexity (Yu, Sengul & Lester, 2008).

The expectation is that, when the task becomes more unstructured and non-routine, the informal leader will perform relatively more task-oriented behavior, while in a routine situation the informal leader will probably perform more supportive behavior (House, 1971). The cause for this change in behavior may be the team requiring more help in coordination in a new situation or the informal leader cutting all unnecessary behavior for bare task execution. Next, for both the informal leader and the boundary spanners, the expectation is that in the non-routine task context, informing and clarifying is more prominent than in the routine task context, as routine work has a negative effect on the process of information sharing (Schippers, Edmondson & West, 2014). Moreover, as the main behavior for a boundary spanner is information sharing (Davison & Hollenbeck, 2011), it could be that this difference in informing

and clarifying in routine versus a non-routine task context is even more noticeable for the boundary spanners.

Based on the above the second research question with sub-question has been formulated:

To what extent does informal leader behavior differ in a non-routine task context versus a routine task context?

- *How is this different from the behavior that a boundary spanner shows in these task contexts?*

As addressed before, this study takes a very precise behavioral approach to analyze informal leadership behavior and behavior displayed by boundary spanners, where previous studies researched MTS processes or the MTS as a whole (Davison et al., 2012). To gain knowledge on informal leader behavior on a detailed level, we take a two-step analysis called abductive reasoning (Behfar & Okhuysen, 2018). First of all, we take a look at the frequencies of the performed behaviors, followed by a qualitative examination of these behaviors. We take this structured explorative approach with the expectation to find qualitative behavioral insights, which could be of great value as a starting point for future research and ultimately the optimization of informal leadership behavior in MTS contexts. The method used to come to these insights is described in the next section.

Method

A case study approach

The goal of this study is to provide insight into the behavior of an informal leader in an MTS context. To achieve this goal, a case study approach has been deployed. First of all, because case studies are appropriate for research that aims at answering the 'how' question in a present-day complex context (Yin, 1999). Second, because research nowadays has highlighted the need to conduct research that "comes closer to the reality of working" (Shuffler, Rico & Salas, 2014). The case has been carefully selected to be seamlessly connecting with the concepts, as defined in the introduction and theoretical framework. Pursuing this ultimate fit is one of the reasons why there has been chosen for a single case of an MTS. The case is a simulation session of the Dutch train traffic control organization ProRail (owner of the railway network in the Netherlands). In the following section, the case will be explained.

The traffic control teams at ProRail are organized as a Multi Team System (MTS). As the process of disruption is managed by multiple teams in different network control centers. Geographically remoted teams have distributed responsibility and decision-making authority and the authority to adjust decisions. Meanwhile, in their decision-making they are interdependent. This corresponds with the definition by Mathieu et al. (2001: 290), 'two or more teams that interface directly and interdependently in response to environmental contingencies toward the accomplishment of collective goals'. They exist to achieve goals too ambitious and extensive to be handled by a single team, by joining forces with multiple teams in the system (Zaccaro & DeChurch, 2012).

Although there is no formally appointed leader in the ProRail MTS, leadership has been proven to be pivotal when it comes to team effectiveness in an MTS context (e.g. Marks et al, 2005; DeChurch and Marks, 2006; DeChurch et al. 2011; Zaccaro and DeChurch, 2012; Bienefeld & Grote, 2014). In the case of ProRail, team members have to follow pre-set protocols and make the right decisions with the given disrupted situation in mind, which makes it a dynamic and, in case of disruption, high pressured environment. For such teams to run successfully, Bennis and Nanus (1985) suggest that effective leadership is essential, especially in this high technology and high-risk environment (Silverthorne, 2001). However, in systems such as MTSs, leadership tasks appear a collective responsibility of numerous individuals (Zaccaro & DeChurch, 2012), these could be formal leaders, but also informal leaders through emergent processes (Carter, DeChurch & Zaccaro, 2014). This is also recognizable in the ProRail case: variable employees with different roles in the team make decisions, depending on the situation.

Participants

The observed teams in this simulation operate in an area with high complexity, which includes Amsterdam Centraal, the second largest train station in the Netherlands, as well as Alkmaar station. The teams involved are; the regional traffic control teams, the RPTCC Amsterdam (Regional Passenger Transport Control Center Amsterdam), and the OCCR (Operational Control Center Rail). An overview of the roles in the teams can be found in table 2. Their roles were similar or equal to their roles in the organization.

Table 1. Overview of teams and roles

Team	Roles
Operational Control Center Rail	National Passenger Traffic Controller National Network Controller
Radio Block Center	Regional Passenger Traffic Junction Coordinator Regional Passenger Traffic Monitor Regional Passenger Traffic Material and Passenger Coordinator
Regional Traffic Control Center Alkmaar	Train Traffic Controller Alkmaar Train Traffic Controller Zaanlijn
Regional Traffic Control Center Amsterdam	Regional Network Controller Train Traffic Controller Amsterdam Westzijde Train Traffic Controller Amsterdam Singelgracht

In terms of demographics, there was a total of 10 participants. They all participated during the whole simulation. The average work experience of the six railway traffic controllers was 20.2 years (SD = 11.38). For the four passenger traffic controllers, the average work experience was 10.7 years (SD = 9.43). Six employees were male and four female. Six of the participants were employed at infrastructure organization ProRail as operators. The other six participants were operators from one of the passenger traffic service organizations using ProRail's railway network.

Research design

ProRail provides its employees with the opportunity to take part in simulations for overall process improvement (Lo & Meijer, 2019). The last simulations took place in 2013. Those video recorded data have been made available for usage in this research.

During the simulation, both a routine and a non-routine scenario were carried out. Scenario 1 corresponded to the current procedure for dealing with disruptions and was therefore marked as the routine scenario. Scenario 2 corresponded to the alternative procedure for tackling the disruption, thus new for the employees, and was therefore marked as the non-routine scenario. The two simulations varied in the way that in the routine task context the teams had to handle the disruption as they normally would, while in the non-routine task context the teams had to work with new predefined protocols in a new situation, which indicates a higher task complexity (i.e. non-routine task) (Wood, 1986). The simulation set-up is described in more detail in appendix D. The video recordings of the simulations of both scenarios have been observed, coded, and analyzed.

Procedure

The simulations took place in a morning and an afternoon session. Both sessions simulated peak hour in the afternoon (16.48 and 17.02). Before the simulation started the employees received an extensive explanation of the similarities and differences of the new (i.e., scenario 2) and old (i.e., scenario 1) work procedures. More details on both scenarios can be found in appendix D.

All the teams that would normally be involved in similar disruptions have been included in this simulation. The teams represented were secluded in four rooms, to simulate the actual physical distance between the teams. All the teams were being video and audio recorded with special attention to the contact between the different teams. Additionally, each control center was supervised by one observer, who occasionally asked about the reasoning behind decisions or actions.

Instrument

To answer the research question, video recordings of a train disruption simulation[3] have been observed and coded employing a specifically developed codebook for this context (appendix A). Nevertheless, the codebook is also relevant for future research conducted in both an MTS or a traffic control context. As described in the theoretical framework, the taxonomy (appendix A) has been developed combining taxonomies from different scientific disciplines. This has been done to get a comprehensive instrument to analyze the full range of behavior in this MTS context. The following taxonomies have been compared; Behrendt (2016), Bienefeld and Grote (2014), Hoogeboom & Wilderom (2019), Meinecke et al. (2017), Yukl (2012) and Zijlstra et al. (2012).

First of all, all behaviors from all taxonomies were organized in one table (appendix B). Then, the overlap between behaviors has been eliminated and captured in one comprehensive code, as addressed in the theoretical framework. Moreover, behaviors exceeding the context were excluded (e.g. networking, external monitoring, and representing). This resulted in one comprehensive taxonomy suitable for this context of MTSs in traffic control contexts. A summarized version is displayed in table 2. The complete codebook with the descriptions of the behaviors and examples can be found in appendix A.

[3] In this study, there has been chosen to make use of simulations instead of real passed disruptions, as disruptions are unpredictable and thus hard to capture. Moreover, gathering complete information of all parties involved during an unexpected disruption, such as train operating companies, is extremely hard, because of all different regulations and legislations concerning, for example, privacy.

Table 2. Taxonomy (i.e. codebook) for informal leadership in an MTS context.

Meta-category	Behaviors
Task-oriented behavior	Clarifying
	Planning
	Structuring meetings
	Monitoring
	Correcting
	Problem-solving
	Informing
	Delegating
	Agreeing
	Disagreeing
Action-oriented behavior	Negative counteractive behaviors
Procedural behavior	Negative procedural behaviors
	Positive procedural behaviors
Relations-oriented behavior	Mental support
	Work related personal development planning
	Recognizing
	Empowering intellectual stimulation
	Negative relation-oriented behaviors
	Neutral relation-oriented behaviors
	Humor
Change-oriented behavior	Advocating change
	Envisioning change
	Encouraging innovation
	Facilitating collective learning
Additional behavior	Additional codes/fillers
Unclassified behavior	Inquiry
	Answer
	Non-work/social

Data analysis

Video and audio recordings of the simulation were available. The conversations across teams have been transcribed for coding analysis purposes. However, coding written text has the disadvantage of missing paralinguistic features (e.g. tone and accent), and therefore misunderstanding of meaning can occur, which results in errors (Ongena & Dijkstra, 2006). To exclude this from happening, there has been chosen to code the video with audio instead of solely the transcript. So in the end, the transcript served only as a reference, to keep the overview of the inter-team communication as a whole.

The 27 mutually exclusive behaviors have been coded in the video, utilizing specialized coding software for the analyses of videos ("The Observer XT," Noldus Information Technology, Noldus, Trienes, Hendriksen, Jansen, & Jansen, 2000; Spiers, 2004). 10% of the data has been coded individually by two coders (Cohen, 1968). Then the coders compared their

results and sharpened the behaviors and definitions to be mutually exclusive. For example, the code decision-making was removed, as it was overlapping with other behaviors. Most disagreements were in the task-oriented meta-category because it is only a small difference between informing and clarifying. So, these two behaviors were further defined (informing: consciously factual information sharing; clarifying: clarify something for oneself, i.e. thinking out loud).

Next, there has been chosen for continuous and exhaustive coding, so all observed behavior has been coded. To be able to engage in this form of coding, the categories 'unclassified' and 'additional' have been added to the meta-categories. These codes were also present in the compared taxonomies, which also had similar (rest) categories, such as additional codes/ fillers (Meinecke et al., 2017) or additional behaviors such as non-work (Zijlstra et al., 2012).

To guarantee the reliability of the coding process, the inter-rater reliability Cohen's kappa has been calculated with 10% of the coded data (Cohen, 1968). Despite the careful adjustments to the codebook, the inter-rater reliability was 74%, cohen's kappa 0.52, which is considered to be a moderate level of agreement (Landis & Koch, 1977). After again taking a critical look at the coding, an explanation for this relatively low kappa has been found: Namely the complex and chaotic simulation (i.e. people interrupting each other, people repeating each other, making half-finished sentences, sometimes finished by others). This has caused imparity in the moment of coding and when to code. So, when both coders assign the same code to the same behavior, but at a slightly different time, the program labels this as a disagreement. When pulling this straight in the program, with a critical eye of both coders, an inter-rater reliability of 92% and a cohen's kappa of 0.92 was reached. Furthermore, for future applications of the instrument, the coders discussed the discrepancy in fine-graininess after coding all the data, which has resulted in points of improvement for future applications. These are presented in the discussion.

After coding, the informal leader has been identified; this has been exanimated by two independent observers. After watching the videos, both observers were independently asked to appoint a leader based on indicators such as centrality, dominance, decision-making, and team members' choice for point of contact and source of information. They both independently appointed the RNC from regional traffic control center Amsterdam as an informal leader[4].

[4] In addition, a Social Network Analysis (SNA) on the data conducted by Lo and Meijer (2019) also appointed the RNC of Amsterdam as the most central and key role in the network.

To answer the research question, the frequencies of the behaviors were sorted per role (i.e. informal leader and boundary spanners) and per scenario (i.e. routine and non-routine). Then, a comparison has been made between behaviors by the informal leader and behaviors by the boundary spanners for each scenario. In addition, the differences between the informal leader and the boundary spanners visible in the two scenarios have been discussed in detail with a qualitative approach in the results section, to gain more insight into the actual behavior and interactions taking place. This approach is also known as abductive reasoning (Behfar & Okhuysen, 2018). All behaviors that were labeled as the same behavior have been bundled for the informal leader and the boundary spanners. Then these bundles of behaviors have been analyzed on resemblances of the behaviors within these bundles. From this, qualitative information has been abstracted per bundle. Last, these qualitative insights have been compared for the informal leader and boundary spanners.

Results

In the following text, the behaviors with relatively the highest frequencies will be presented. These behaviors are informing, clarifying, and delegating (belonging to the task-oriented behavior meta-category). Because of the high frequencies, these behaviors were most reliable and suitable for the qualitative analysis.

This will be done per scenario, in which per behavior in-depth information will be given on how the informal leader and the boundary spanner use this behavior in their role, followed by a comparison. In addition to the in-depth analysis, the broad behavioral repertoire of the informal leader and the boundary spanners will be compared in terms of frequencies. After this, differences and similarities will be presented for the informal leader in the routine versus the non-routine scenario. This will also be done for the boundary spanners. Table 3 presents the percentages of performed behavior by the informal leaders and the boundary spanners divided into routine vs non-routine procedures[5].

Scenario 1: routine situation

Informing. Informing behavior by the informal leader seems to have an inter-team character, which means that he directs his communication mostly towards other teams. In other words, the leader is mostly externally orientated when it comes to providing factual

[5] An overview table of both scenarios for the informal leader and boundary spanners can be found in appendix E.

information. Furthermore, the informal leader uses informing for the distribution of information about steps to take (i.e. decisions) and the spreading of relevant information.

The boundary spanners performed informing behavior predominantly intra-team, thus directed their communication mostly towards members of their own team. They received information from others in the MTS and immediately passed this information on to their team members. For example, the informal leader informs the boundary spanners about new directions. The boundary spanner receiving this message immediately passes this information on to the rest of his team. In other words, the boundary spanners often take the role of a transfer point of information to the rest of their team.

Comparing the behavior of the informal leader with the boundary spanners, first of all, shows that 'Informing' behavior is relatively more performed by the informal leader than by boundary spanners (43.56%/36.27%)[6]. Second, they differ in the direction of informing (i.e. internal vs external). Third, informing behavior is utilized differently by the informal leader than by the boundary spanners. Namely, by the informal leader to spread new information with his own input (e.g. decisions), while the boundary spanners often passed information through without any personal input. This is also reflected in the following quote:

Intentionally left blank

Clarifying. Clarifying behavior by the informal leader included behavior such as inquiring about the status of trains or disruptions. Furthermore, clarifying behavior by the informal leader was mostly passive in the routine task context. For example, the informal leader starts the phone call with informing intentions. However, the response by the boundary spanner at the other side of the line made the informal leader start clarifying to gain an overview of the newly gained information. So, the intention of the informal leader was not to clarify, however the reaction of the boundary spanner sort of 'forced' the informal leader to clarify. This is illustrated in the following quote:

[6] Between the brackets, first the percentage of the informal leader is presented followed by the percentage of the boundary spanners.

Intentionally left blank

An active attitude seemed not needed for the informal leader, as all the boundary spanners did 'automatically' inform the informal leader when they considered new information as relevant for the informal leader.

Clarifying behavior displayed by the boundary spanners was active in nature because they are proactively approaching the informal leader and other boundary spanners to acquire information. An example is given in the following quote:

Intentionally left blank

Within the teams, it seemed to be less necessary to proactively acquire, organize, and evaluate information to gain an overview, because new externally collected information was directly shared within the team when received.

Comparing the behavior of the informal leader with the rest, first of all, shows that 'clarifying' behavior was relatively more performed by the boundary spanners (28.71%/32.87%). Second, clarifying happened for both the informal leader and the boundary spanners mostly at an inter-team level. Thus, they both used clarifying to gain information from other teams. Third, clarifying behavior by the informal leader was often passive in nature, where this was active in nature by the boundary spanners.

Delegating. Delegating behavior by the informal leader included assigning procedural tasks to the boundary spanners, but predominantly directing TTCs. An example is given in the following quote:

Intentionally left blank

The boundary spanners mostly delegated to fellow boundary spanners in their team and employees in the system, but outside the simulation, for example, to train drivers. Moreover, boundary spanner did barely delegate to the informal leader.

Comparing the behavior of the informal leader with the rest, first of all, shows that the informal leader performed relatively more 'delegating' than the boundary spanners (13.86%/5.09%). Second, although this organization applies a horizontal hierarchy, the practice

seems to show a more traditional hierarchy around the informal leader, with top-down delegating, as the informal leader delegates to everyone, but nobody delegates to the leader.

On a meta-category level (see table 3), comparing the behavior of the informal leader and the boundary spanners in the routine scenario, the informal leader performs relatively more task-oriented behavior than the boundary spanners (99,01% vs. 87.96%). Furthermore, the informal leader did not perform any relations-oriented behavior (0,00%), whereas boundary spanners did perform relations-oriented behavior (2.62%). Moreover, the informal leader did not show procedural behavior and action-oriented behavior, while boundary spanners did perform procedural behavior (2.47%) and action-oriented behavior (0.93%). Thus, the behavior of the informal leader tends to be mainly aimed at task-oriented behavior, while the behaviors of the boundary spanners also cover relations-oriented behavior, procedural behavior, and action-oriented behavior.

Table 3. Frequency of performed behavior in the routine scenario

		Informal leader	Boundary spanners
Task-oriented	Informing	**43.56%**	36.27%
	Clarifying	28.71%	**32.87%**
	Delegating	**13.86%**	5.09%
	Problem solving	**7.92%**	3.86%
	Planning	**4.95%**	3.24%
	Agreeing	-	**2.93%**
	Monitoring	-	**2.01%**
	Disagreeing	-	**1.08%**
	Correcting	-	**0.46%**
	Structuring meetings	-	**0.15%**
	Total	***99.01%***	*87.96%*
Relations-oriented	Humor	-	**1.08%**
	Recognizing	-	**0.77%**
	Empowering intellectual stimulation	-	**0.31%**
	Mental support	-	**0.15%**
	Neutral relation-oriented behaviors	-	**0.15%**
	Negative relation-oriented behaviors	-	**0.15%**
	Total	**-**	***2.62%***
Procedural behavior	Positive procedural behaviors	-	**2.47%**
Action-oriented	Negative counteractive behaviors	-	**0.93%**
Additional	Additional codes/fillers	-	**-**
Unclassified	Inquiry	-	**2.01%**
	Answer	-	**1.39%**
	Non-work/social	0.99%	**2.62%**
	Total	*0.99%*	***9.41%***
Total		**100.00%**	**100.00%**
Total behaviors		**101**	**648**

Scenario 2: non-routine situation

Informing. Informing behavior by the informal leader is recognized by the decision-making character. A lot of conversations took place in which the informal leader was discussing with boundary spanners about what step to take next or how something was going to happen. In these kinds of conversations, the informal leader eventually took the lead or was given the lead to decide in the end, which is coded as informing.

The boundary spanners discussed among each other about steps to take and provided factual information in these conversations and performed clarifying behavior towards the informal leader in which the leader eventually made the decision. Such a situation is illustrated in the following quote:

Intentionally left blank

Comparing the behavior of the informal leader with the rest, first of all, shows that ‘informing’ behavior is during non-routine procedures again relatively more performed by the informal leader than the boundary spanners (41.01%/31.35%). Second, the informal leader used informing behavior to express his decisions, while boundary spanners gave the informal leader the lead in making a decision. The boundary spanners had another purpose in informing, namely providing factual information in discussions.

Clarifying. The informal leader performed clarifying less passive than in the non-routine situation. The informal leader had more questions and was less confident in the overview he had of all relevant information to lead the disruption successfully. The informal leader proactively gathered his information from the other boundary spanners and used clarifying behavior to get informed by the boundary on updates and information about the disruption. An illustration of this behavior is given in the following quote:

Intentionally left blank

Boundary spanners showed out loud questioning information from the computer system or procedures and sometimes discussed with fellow boundary spanners in the team. Furthermore, the boundary spanners contacted the informal leader for confirmation or information about the procedure in case of uncertainty:

Intentionally left blank

Comparing the behavior of the informal leader with the rest, first of all, shows that the informal leader performed relatively more ‘clarifying’ behavior than the boundary spanners (28.06%/25.81%). Second, it shows that both the informal leader and boundary spanners showed more uncertainty and actively used more clarifying to gain more certainty.

Delegating. The informal leader showed, similar to the routine scenario, delegating behavior towards the boundary spanners. However, the informal leader tended to do this in consultation with the relevant boundary spanner, while he did not do this in consultation in the routine situation. Thus, the informal leader was more restrained in his delegating behavior than in the routine situation. But in the end, it was the informal leader that delegated the task. An illustration of this is reflected in the following quote:

Intentionally left blank

The boundary spanners did not delegate to the informal leader, but to employees outside the simulation, such as train drivers.

Comparing the behavior of the informal leader with the rest, first of all, shows that the informal leader performed relatively more ‘delegating’ behavior (9.35%/3.51%). Second, also in this non-routine scenario, there seems a top-down hierarchy, however, the informal leader does the delegating more in consultation, by for example checking on the workload to see whether the task can fit in the task scheme of the receiver of the task.

On a meta-category level (see table 4), comparing the behavior of the informal leader and the boundary spanners in the scenario with the non-routine procedures, the informal leader performs substantial more task-oriented behavior than the boundary spanners (96.40%/69.46%), whereas the boundary spanners perform relatively more relations-oriented behavior (0.72%/6.35%). Zooming in on task-oriented behaviors, the boundary spanners perform a broader variation in behaviors. The boundary spanners show behavior in ‘agreeing’, ‘disagreeing’, ‘correcting’ and ‘structuring meetings’, while the informal leader does not show this behavior. Thus, the behavior of the informal leader again tends to be mainly aimed at task-oriented behavior, however less than in the routine situation. The behavior of the boundary

spanners also mainly covers task-oriented behavior but also relations-oriented behavior, procedural behavior, and action-oriented behavior.

Table 4. Frequency of performed behavior in the non-routine scenario

		Informal leader	Boundary spanners
Task-oriented	Informing	**41.01%**	31.35%
	Clarifying	**28.06%**	25.81%
	Delegating	**9.35%**	3.51%
	Problem solving	**8.63%**	2.84%
	Planning	**5.04%**	2.57%
	Agreeing	-	**0.81%**
	Monitoring	**4.32%**	1.08%
	Disagreeing	-	**0.81%**
	Correcting	-	**0.54%**
	Structuring meetings	-	**0.14%**
	Total	***96.40%***	*69.46%*
Relations-oriented	Humor	-	**5.00%**
	Recognizing	-	**0.27%**
	Empowering intellectual stimulation	-	**0.54%**
	Mental support	**0.72%**	0.27%
	Neutral relation-oriented behaviors	-	**0.27%**
	Negative relation-oriented behaviors	-	-
	Total	*0.72%*	***6.35%***
Procedural behavior	Positive procedural behaviors	**1.44%**	0.95%
Action-oriented	Negative counteractive behaviors	-	**0.14%**
Additional	Additional codes/fillers	-	**0.14%**
Unclassified	Inquiry	0.72%	**1.22%**
	Answer	**0.72%**	0.68%
	Non-work/social	-	**21.08%**
	Total	*2.88%*	***24.19%***
Total		**100.00%**	**100.00%**
Total behaviors		**139**	**740**

Routine versus non-routine task context

Comparing the behaviors shown in the routine versus the non-routine task context, some differences can be found in the executions of the behaviors. These will be addressed in the following text.

Informal leader

In the routine task context, the informing behaviors of the informal leader are primarily for the provision of factual information about decisions he has made concerning steps to take. In the non-routine task context, the informing behavior changes for the informal leader to on the spot decision-making. With on the spot decision-making is meant that the informal leader, at the end of a discussion, takes the lead in making the decision, instead of starting the conversation already knowing what decisions or steps he wants to communicate.

In the routine task context, clarifying by the informal leader happens merely passive, while during non-routine procedures this was more active. With active is meant that a person calls someone else with the main intention of clarifying. Passive is when clarifying happens as a response to someone that called with the intention of informing.

When looking at delegating behavior, in the routine situations a more traditional hierarchy developed, in which the informal leader delegates with attitude. During the non-routine scenario, he still performs delegating behavior, but the informal leader does this in consultation with the boundary spanner by, for example, gauging the workload before delegating the task. In other words, in the non-routine situation, the informal leader is more restrained in his delegating, whereas in the routine scenario he delegates with attitude and confidence.

Boundary spanners

In the routine scenario, the boundary spanners also showed informing primarily in the provision of factual information. However, the boundary spanners were more of a transfer point of information towards their team. In the non-routine scenario, this does barely change for the boundary spanners. Also clarifying behavior does barely differ in both scenarios: The boundary spanners performed clarifying actively in both scenarios.

In terms of delegating behavior, there is again not much difference in the execution of the behavior in the two scenarios. In both they do perform this behavior, but not towards the informal leader. On the other hand, there is a difference in the reaction the boundary spanners have in the delegating behavior of the informal leader. In the routine scenario. the boundary spanners take a more wait and see attitude. In the non-routine scenario, the boundary spanners are more engaged in the division of tasks.

In short, the way behaviors are executed change when the task context changes, but this is more visible for the informal leader than for the boundary spanners. Furthermore, clarifying during routine procedures is merely executed by boundary spanners, while during non-routine procedures, the informal leader performs this behavior relatively more. The other behaviors were relatively more performed by the informal leader in both scenarios.

Discussion

By creating a taxonomy (i.e. codebook), this case study has set the first step in observing informal leadership behavior on a micro-behavioral level and boundary spanners in the context of an MTS. This study aimed at answering the following research questions and sub research questions:

How does an informal leader behave in an MTS context?

- *How is this different from the behavior that a boundary spanner shows in this context?*

To what extend does informal leader behavior differ in a non-routine task context versus a routine task context?

- *How is this different from the behavior that a boundary spanner shows in these task contexts?*

Broadly, the following results answer these research questions. First of all, task-oriented behavior was most occurring. The informal leader barely executed any other behaviors than task-oriented behaviors, whereas boundary spanners show a wider variety of behaviors in all meta-categories. Furthermore, small differences were found between the routine and the non-routine procedures and between behavior executed by the informal leader and the boundary spanners.

The informal leader actively spreads information and passively acquirs information. The task context changed the behavior of the informal leader in a way that, in the non-routine situation, the informal leader is more restrained in his decision-making and delegating, whereas in the routine scenario he delegates with attitude and confidence. Also, the informal leader takes a more active role in gathering information in the non-routine task context than in the routine task context.

The boundary spanners perform behaviors that aim at actively acquiring confirmation and information and distributes this information within their team. Furthermore, the results show that the behavior of the boundary spanners barely change between the two task contexts. Last, the qualitative insights show that although the organization applies a horizontal hierarchy, the practice seems to show a more traditional hierarchy around the informal leader, with top-down delegating in both task context. However, this was more visible in the non-routine task context.

Next, in the theoretical framework, some expectations have been formulated concerning the occurrence of behaviors. In the following sections, these expectations will be discussed with the results. After that, the results of our explorative qualitative insights will be presented in the light op future research opportunities. Next, the theoretical and practical implications will be addressed, followed by the limitations and other suggestions for future research.

Informal leader and boundary spanners' behaviors

First of all**,** some behaviors from the taxonomy did not occur for both the informal leader and the boundary spanners, for example, all behaviors from the meta-category change-oriented behavior. Yet, this can be explained by the current literature. Gerpott (in press) proves that change-oriented behavior predicts emergent leadership in the first team phase of a team's lifecycle, but diminishes in relevance in the subsequent phases. At ProRail, they all work together for a longer time; thus, the teams have all passed the point of phase one of the team phases. Which could partly explain the absence of change-oriented behavior.

For an informal leader in an MTS, the expectation was that he would mostly show task-oriented behavior to complete tasks, because of the high pressure and often ad hoc nature of situations MTSs have to deal with (DeChurch et al, 2011). When looking at the frequencies of the performed behavior, it shows that an informal leader in an MTS context indeed mostly shows task-oriented behavior. More specifically, he mostly shows informing and clarifying behavior. This matches with the idea that all MTS members in our case are boundary spanners, and therefore would most likely show the behavior of gathering, filtering and distributing information (i.e. informing and clarifying), to coordinate the flow of information through the MTS as a whole (Davison & Hollenbeck, 2011).

In terms of the additional behaviors that are suggested to be displayed by the informal leader, our results add specificity to what these behaviors entail; an informal leader shows specifically delegating, problem-solving and planning behavior on top of informing and clarifying behavior. These also are all task-oriented behaviors, which again matches with the expectation that an informal would predominantly show task-oriented behavior in an MTS.

Furthermore, from traditional leadership literature, we know that (effective) leadership consists of task- and relation-type behaviors (Hoogeboom & Wilderom, 2015). In addition, Wijnmaalen et al. (2017) theorized that the leader in an MTS context should perform behaviors which stimulate processes (e.g. mutual trust) that enhance MTS coordination: i.e. relation-oriented behaviors (e.g. Edmondson, 2014), our results show that the informal leader limits its behavior to task-oriented behavior. Similar results were found in a study by Hoogeboom & Wilderom (2015) in which they found that leaders mostly showed task-oriented behavior during team meetings. It also is consistent with the above-described expectations, that an informal leader in an MTS mostly shows task-oriented behavior. Moreover, Wijnmalen et al. (2017) describe that, in theory, it would be beneficial for a leader to show behavior that enhances mutual trust. However, they do not claim that it is happening in all MTSs. Our results show that in this specific MTS, relations oriented behavior is barely performed by the informal leader.

The expectation was that boundary spanners would predominantly perform behaviors of gathering, filtering, and distributing information in an MTS context (Davison & Hollenbeck, 2011). Our results indeed show that, similar to the informal leader, gathering, filtering, and distributing information (i.e. informing and clarifying) were most occurring. These most occurring behaviors were similar for the informal leader and boundary spanners. An explanation for this is the positions all MTS members have in this case study, namely the position of boundary spanners. And for boundary spanners and MTSs in general, gathering, filtering, and distributing information is essential for MTS success (Davison & Hollenbeck, 2011).

In addition to these, boundary spanners showed all other behaviors from the taxonomy, although into a lesser extent than informing and clarifying. In contrast with behaviors performed by the informal leader, the boundary spanners performed a wide variety of relation-oriented behavior. Our results thus show that in our case study, relations-oriented behavior is being performed within the MTS, however, not by the informal leader, but by the boundary spanners. A possible explanation for this could be the difference in work pressure. The informal leader is constantly occupied coordinating the disruption, which is also reflected in the numerous times boundary spanners fail in attempts to reach him. It is most likely that because of the pressure the informal leader experiences, he limits his behavior to task-oriented behavior. On the opposite, the boundary spanners, have lower work pressure and therefore have more time and room for relation-oriented behavior, such as making jokes (House, 1971).

Task context

The expectations towards the routine versus non-routine situation were that, similar to traditional leadership research outcomes, in a non-routine situation, the informal leader would perform more task-oriented behavior (Schippers et al., 2014), while in a routine situation the informal leader would probably perform more supportive behavior (House, 1971). More specifically, we expected that both the informal leader and boundary spanners would show less informing in the routine scenario, as routine tasks have a decreasing effect on information sharing (Schippers, Edmondson & West, 2014). In this study, the results show exactly the opposite, for both the informal leader and the boundary spanners; the informal leader shows slightly more task-oriented behavior in the routine context, the boundary spanners do as well. Furthermore, they both show more relations-oriented behavior in the non-routine context. This can be explained by the set-up of the simulation: in the routine scenario, the informal leader decides which steps to take and communicates and explains these to the rest of the MTS. In the

non-routine scenario, the employees had to work with new pre-set plans A, B, and C, and everyone had access to these plans. These plans described which steps they had to follow in solving the disruption. Although some uncertainties arose, overall there was less to inform about the procedure and clarifying about which steps to take, as the informal leader could simply communicate which plan to follow and everyone could read for themselves what to do.

Another unexpected finding is that the difference in the amount of performed task-oriented behavior by the informal leader and boundary spanners is larger in the non-routine task context than in the routine task context. This result mostly occurs because the boundary spanners perform a lot of non-work/ social and humor behavior compared to the routine context, which made task-oriented look less executed in percentages of the total behaviors. The non-work/social and humor happened in the time that the teams were not relevant for the coordination of the disruption yet, so they filled this time with small talk.

Because taking task context into account in research in MTS is new, there was a minimum of information available. Therefore, comparing these outcomes of this study with others was impossible yet.

Explorative findings

Furthermore, qualitative insights were gained in this research; the most prominent findings were on informing, clarifying and delegating, which show at the same time, the biggest differences between the informal leader and boundary spanners. Also, these behaviors were most reliable and suitable for the qualitative analysis, because of the high frequencies. In the following text, the explorative insights will be addressed, together with ideas on what these could mean for future research.

Overall, it was noticeable that the task context did change the behavior execution of the informal leader. For the boundary spanners, the task context did not change the way they executed their behavior. So, we could say that, in this case study, task context does not change the behavior of boundary spanners on a qualitative level.

Informing behavior by the informal leader changes in the non-routine context to a decision-making character (i.e. providing information in a discussion, to come to a decision and communicating this decision), instead of passing on basic factual information about the disruption. For the boundary spanners, this was in both the task contexts mostly passing on factual information from outside their team to inside their team. Thus, the leader takes the decisions and more often in the non-routine task context (House, 1971). For future research, this knowledge can be an opening. For example, by following the flow of information within

an organization, to see which roles are involved in the process of information sharing in which way.

Next, clarifying also differs in both the task contexts. In the routine task context, clarifying by the informal leader happens merely passive, while during non-routine procedures this was more active. For the boundary spanners, this was in both cases active. With active is meant that the person calls someone else with the main intention of clarifying. Passive is clarifying as a response to someone that called with the intention of informing. These findings could be further studied in terms of effectivity. What does this distinction in active versus passive clarifying mean for the effectiveness of an MTS?

Last, delegating behavior happened in the routine context according to a traditional hierarchy, while the informal leader took a more restrained role, dividing tasks in consultation. This result was somewhat unexpected as the organization applies a flat organizational structure. Therefore, future researches could study what the role of hierarchy is in an environment with informal leadership or 'flat' organizations. This is even more relevant nowadays, as more and more organizations go towards a 'flat' organization with self-managing teams (Hoda, Noble & Marshall, 2012).

The 'why' question to these findings could be answered with the definition for informal leadership: 'those not in positions of leadership but recognized as leaders nevertheless' (Pielstick, 2000). In other words, although the leader in this case study is an informal leader, it is recognized as a leader nevertheless. This could be the reason the boundary spanners start treating him as a leader and the informal leader start to behave like a traditional leader (i.e. transactional/hierarchical leader). Therefore, we see a more wait and see behavior by the 'followers' and more active behavior in informing, decision-making, delegating by the informal leader (Anderson & Sun, 2017).

Although these insights are specific for the case in our study, future studies should point out whether these are generalizable to other MTS systems and further our understanding of informal leadership behavior in an MTS context. Thus, to what extent the behavior by the informal leader differs in a routine versus a non-routine task context.

Theoretical implications

This study provides theoretical implications in several ways. In general, it adds to the growing literature on MTS which is rising since a couple of years (e.g., Landon et al., 2018; Ervin et al., 2018; Fiscella & McDaniel, 2018; Power, 2018). It provides a qualitative insight in performed micro-behavior by an informal leader in an MTS context, where previous studies

focused on MTS processes or the MTS as a whole (Davison et al., 2012). With this, the current study provides an answer to the repeated call for research into informal leadership in an MTS context (e.g. Burke et al., 2011; Davison et al., 2012; Fleştea et al., 2017). Furthermore, by doing this on a micro-behavioral level, this study is one of the first to paint a detailed picture of behavior by an informal leader in an MTS context. The knowledge gained with this approach could be of value for future informal leadership research but also practice. For example, an organization wants to flatten the hierarchy by removing all formal leaders. Then it can be valuable information to have, that informal leadership can also result in hierarchical situations.

In addition, it shows that an informal leader in an MTS shows different behavior than boundary spanners. This is mostly visible in nuances of behavior, for example, the informal leader shows more passive clarifying behavior, where the boundary spanners show more active clarifying behavior towards the informal leader. Because boundary spanning is often seen as a characteristic by a leader (e.g. Edmondson, 1999) and rarely as a separate role, there is scarce information available on the difference in behavior in the two roles. This research provides more insight in the distinction of these roles in terms of behavior.

Last, this study provides insight into the differences in behaviors visible between routine versus non-routine task contexts in an MTS context. In most literature, MTSs are seen as a system designed to handle non-routine, dynamic task domains (DeChurch et al., 2012). Therefore, the distinction between routine versus non-routine task contexts is seldom made in an MTS context. Nevertheless, the results did show differences in frequencies of behavior and the way the behaviors were executed between the two scenarios. This confirms the idea by Kerr (2017) that the task context influences the behavior that is being performed in a group, which offers chances for future research.

Practical implications

The current study aimed at mapping behaviors on a micro-behavioral level. This has led to very detailed insights into behaviors performed in an MTS. However, this study mapped the current situation and thus not the effects of certain behavior on, for example, MTS performance. Therefore I can not state which behaviors to stimulate to increase MTS performance and which not. What can be stressed is that the way informal leadership is carried out, differs from task context to task context. Thus, although researchers suggest that informal leadership is most suitable for an MTS (e.g. Zaccaro, Marks & DeChurch, 2012; Bienefeld & Grote, 2014), the task context has to be taken into account. Therefore, for practice, I would suggest sketching scenarios of different task contexts that could occur and think ahead of what this could mean

for the behavior of the informal leader, before switching to a completely flat organization with informal leadership. This to be ahead of undesired outcomes.

Furthermore, for the case study organization, the developed taxonomy can be utilized to conduct further research in the organization. For example, to observe future real-life disruptions, but also to observe behavior after an intervention, such as leadership training.

Limitations

A qualitative case study design has its strengths and weaknesses. Although careful examination of the case study, some (methodological) limitations can be addressed. First, this study is a case study, which provides valuable insights into behavior in an MTS context. On the other hand, the case study design implies weak generalizability. I would recommend using our data as part of a sample for a study with a multiple case study design (e.g. Wijnmaalen, et al., 2017).

Second, in the current study, two independent assessors indicated the informal leader, and this choice was substantiated by social network analysis (Lo & Meijer, 2019). This method has been chosen because the data was given and thus it was not possible to ask the participants. Yet, an informal leader is only an informal leader if it is recognized as such by fellow team members (Pielstick, 2000). Therefore, I would suggest changing the method for identifying the informal leader in the future. I would recommend having this assessed by team members. A more reliable method could be a round-robin rating design, in which team members have to indicate the extent to which each team member emerged as the leader (e.g. Lanaj & Hollenbeck, 2015; Gerpott, et al., in press).

Third, the simulations were table-top simulations instead of real-life. Although the simulation was carefully designed, some flaws came forward during the simulation. This made it less close to reality. However, it did accentuate the non-routine scenario, which could have made identifying the informal leader easier (Bienefeld & Grote, 2014). Nevertheless, it could also have reduced the difference visible between the routine and non-routine scenarios, as the routine scenario became somewhat non-routine because of the flaws. Therefore, for future research, specifically for this case, I would suggest improving the simulation. Yet, ideally, real life situations should be analyzed.

Concerning the developed taxonomy, some improvements can be made. In the taxonomy of this study, there has been chosen to maintain the original meta-categories proposed by the authors, instead of sliding the behaviors of these meta-categories into other meta-categories, such as task-oriented behaviors and relations-oriented behaviors, as this would have

been ungrounded. However, with different taxonomies being merged into one, I would suggest for future research to perform a factor analysis on this new taxonomy (e.g. Yukl, 1999), to determine the fitting of the meta-categories to the behaviors. And thus, whether the meta-categories of Yukl (2012) are still applicable and grounded or new meta-categories should be added.

Last, some improvements in the taxonomy can be made that could increase the interrater reliability. First, the taxonomy includes 29 behaviors. This makes coding slightly more difficult than with a smaller taxonomy. However, with the given descriptions, this should not cause any problems. Yet, behaviors from the meta-categories 'additional' and 'unclassified' could have been removed, as they do not provide sufficient information in the context of this study. So, I would suggest adding only one rest category for all executed behaviors that do not meet the behavioral descriptions from the other meta-categories. Second, for the fit of the taxonomy to the context, behaviors such as 'representing' and 'external monitoring' by Yukl (2012) have been left out of the taxonomy. However, what has to be taken in mind is that these behaviors could be applicable in other contexts exceeding the conditions of this case study.

Suggestions for future research

In the previous section, some suggestions for future research were already addressed. In addition to these, some more suggestions are being made in the following section.

This study shows the nuances of behavior performed by an informal leader in an MTS. However, as described in the practical implementations, this study did not measure any outcomes of performed behavior. To improve management efforts to improve leadership effectiveness, future research should also measure the (perceived) team effectiveness of these behaviors (e.g. Hoogeboom & Wilderom, 2019; Davison & Hollenbeck, 2012).

In current research on informal leadership in MTS, a distinction is being made between emergent leadership and shared leadership. In this study, the overarching concept 'informal leadership' has been used, as the specific form of informal leadership can be hard to capture, because it can differ from situation to situation (Zaccaro & DeChurch, 2012). Therefore, I would suggest, similar to Anderson and Sun (2018) for formal leadership styles, to first develop a methodology to accurately examine the form of informal leadership taking place, before continuing with observational research focused on either shared leadership or emergent leadership in an MTS context.

Moreover, for future research on the effectiveness of informal leader behaviors, I would suggest making a distinction between intra-team behavior and inter-team behavior (i.e.

behaviors within teams and behaviors across teams). Our study shows that some roles are more inter-team orientated and other more intra-team. Most studies focus either on intra-team or inter-team behavior even though effective factors for processes within teams can be ineffective and even harmful in coordination processes across teams (Lanaj et al., 2013). Therefore, I recommend, observing both inter-team processes and intra-team processes in one MTS.

Next, this study showed that there are differences notable in the behavior of the informal leader in the routine versus the non-routine situation, while DeChurch et al. (2011) claim that MTSs are normally handling dynamic non-routine task-oriented situations. No research in MTS has made this distinction before. Therefore, I suggest taking this study as a starting point to continue research into MTS in routine versus non-routine situations.

Boundary spanning in an MTS is often studied as a characteristic of a formal/informal leader, but seldom as a stand-alone role (e.g. Edmondson, 1999; Davison et al., 2012). The current study has shown that when a boundary spanner is treated as a stand-alone role, a difference in behavior can be noticed between boundary spanners and an informal leader in a boundary spanning position. Therefore I think the following questions may be interesting to study as a follow-up from this newly gained knowledge; What kind of behavior do boundary spanners show in different contexts? And to what extent does it differ if there is a formal leader present from when an informal leader is present?

Conclusion

This research aimed at developing a multidisciplinary comprehensive taxonomy, to gain insight into how an informal leader behaves in an MTS context and how this differs from the behavior displayed by boundary spanners in a routine and non-routine situation.

In the case study, task-oriented behavior was most occurring. The informal leader barely executed any other behaviors than task-oriented behaviors, whereas boundary spanners show a wider variety of behaviors in all meta-categories. Furthermore, small differences were found between the routine and the non-routine procedures and between behavior executed by the informal leader and the boundary spanners.

The difference in behavior between the informal leader and the boundary spanners is the intention with which they execute the behavior. The informal leader actively spreads information and passively acquires information. The boundary spanner performs behavior to actively acquire confirmation and information and distributes this information within their team. Furthermore, the qualitative insights show that although the organization applies a horizontal hierarchy, the practice seems to show a more traditional hierarchy around the

informal leader, with top-down delegating. Last, the task context did change the way the informal leader executed his behavior. On the other hand, it did not seem to influence the behavior of the boundary spanners.

At last, with some improvements, the developed taxonomy can be used in further real-life observations. Furthermore, this study has uncovered some chances for future research, such as further research into informal leadership behavior in non-routine versus routine situations. Also, the role of boundary spanners could further be discovered. For example, on how behavior by this role could enhance MTS effectiveness, in addition to the informal leader.

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Appendix A

Table 5. Definitions and examples of spoken text

Meta-analytic category	*Code*	*Description*	*Example*
Task-oriented	Clarifying	Somebody proactively acquires, organizes, and evaluates information to gain an overview, identify the causes, or elaborate solutions and requirements for problem solving	Intentionally left blank
	Planning	Determining the current direction; develops short-term plans for the work; determines how to schedule and coordinate activities to use people and resources efficiently; coordinates the pace and timing of activities; determines the action steps and resources needed to accomplish a project or activity	
	Structuring meetings	Structuring the meetings; changing the topic; shifting towards the next	
	Monitoring	Checks on the progress and quality of the work; asking team members for, and confirmation about (the progress on) their tasks; (examines relevant sources of information to determine how well important tasks are being performed; evaluates the performance of members in a systematic way: Yukl, 2012).	
	Correcting	Somebody intervenes, or corrects faulty actions or decisions made by others; criticizing	
	Problem solving	Identifies work-related problems that can disrupt operations, illustrates a solution makes a systematic but rapid diagnosis, and takes action to resolve the problems in a decisive and confident way.	
	Informing	Giving factual information	
	Delegating	Dividing tasks among team members (without enforcing them); delegates responsibility and authority to members for important tasks	
	Agreeing	Agreeing with something; consenting with something	
	Disagreeing	Contradicting with team members	

Action-oriented	Negative counteractive behaviors	Showing no interest in change, complaining, denying
Procedural behavior	Negative procedural behaviors	That is, running off-topic/losing the train of thoughts in details and examples
	Positive procedural behaviors	Somebody instructs others on how a task or procedure should be done
Relations-oriented	Mental support	Shows concern for the needs and feelings of individual members; provides support and encouragement when there is a difficult or stressful task, and expresses confidence members can successfully complete it.
	Work related personal development planning	Paying attention to each individual's need for achievement and growth by acting as a coach or mentor and creating a supporting climate; direction of personal development, action planning of development; provides helpful feedback and coaching for members who need it; provides helpful career advice; encourages members to take advantage of opportunities for skill development.
	Recognizing	praises effective performance by members; provides recognition for member achievements and contributions to the organization; recommends appropriate rewards for members with high performance.
	Empowering intellectual stimulation	Somebody asks others for their opinion; involves members in making important work- related decisions and considers their suggestions and concerns; allows team members to resolve work-related problems without prior approval; asking for ideas, stimulating team members to critically think about team tasks, opportunities and so on, including the questioning of assumptions; thinking about old situations in new ways
	Negative relation-oriented behaviors	That is, interrupting, self-promotion
	Neutral relation-oriented behaviors	That is, listening
	Humor	Laughter

Change-oriented	Advocating change	explains an emerging threat or opportunity; explains why a policy or procedure is no longer appropriate and should be changed; proposes desirable changes; takes personal risks to push for approval of essential but difficult changes.
	Envisioning change	communicates a clear, appealing vision of what could be accomplished; links the vision to member values and ideals; describes a proposed change or new initiative with enthusiasm and optimism.
	Encouraging innovation	talks about the importance of innovation and flexibility; encourages innovative thinking and new approaches for solving problems; encourages and supports efforts to develop innovative new products, services, or processes.
	Facilitating collective learning	uses systematic procedures for learning how to improve work unit performance; helps members understand causes of work unit performance; encourages members to share new knowledge with each other.
External	Networking	attends meetings or events; joins professional associations or social clubs; uses social networks to build and maintain favorable relationships with peers, superiors, and outsiders who can provide useful information or assistance.
Additional	Additional codes/fillers	Pause (>5 seconds), non-comprehensible, interrupted sentence, external disturbance (e.g., phone rings)
Unclassified	Inquiry	Basic request for information
	Answer	Supplying information for an inquiry
	Non-work/social	Social non-task communication

Appendix B

Table 6. Overview taxonomies from literature

Yukl (2012)	*Bienefeld & Grote (2014)*	*Hoogeboom & Wilderom (2019)*	*Zijlstra, Waller & Phillips, 2012*	*Meinecke, Lehmann-Willenbrock & Kaufeld, 2017*	*Behrendt, Matz & Göritz, 2016*
Clarifying clearly explains task assignments and member responsibilities; sets specific goals and deadlines for important aspects of the work; explains priorities for different objectives; explains rules, policies, and standard procedures.	**Clarifying** Somebody proactively acquires, organizes, and evaluates information to gain an overview, identify the causes, or elaborate solutions and requirements for problem solving **Coaching** Somebody instructs others on how a task or procedure should be done or provides clarification about decisions or plans		**Suggestion** Recommendation for action **Inquiry** Request for information	**Positive procedural behaviors** For example, goal orientation, procedural suggestions, procedural question, clarifying, reading out loud	**Fostering coordination** (1) communicating the procedure explicitly and maintaining the structure of communication, (2) ensuring and communicating decisions, (3) employing standardized processes and (4) conveying personal competence and certainty while doing the above. **Enhancing understanding** (1) evaluating prior actions and their results, (2) attributing the results to causes, (3) providing information and (4) inferring beliefs regarding the situation at hand, the situation's supporting and hindering factors and actors, and their contingencies **Facilitating implementation** (1) forming implementation plans and plans for overcoming obstacles, (2) acquiring resources and gaining support, (3) developing skills, (4) identifying opportunities for implementation and (5) activating, focusing and guiding implementation.
Planning develops short-term plans for the work; determines how to schedule and coordinate activities to use people and resources efficiently; determines the action steps and resources needed to accomplish a project or activity.	**Planning and organizing** Somebody plans and communicates next steps, determines the sequence of actions, or coordinates the pace and timing of activities	**Structuring** Structuring the meetings; changing the topic; shifting towards the next		**Positive procedural behaviors** For example, goal orientation, procedural suggestions, procedural question, clarifying, reading out loud **Positive proactive behaviors**	**Fostering coordination** (1) communicating the procedure explicitly and maintaining the structure of communication, (2) ensuring and communicating decisions, (3) employing standardized processes and (4) conveying personal competence and certainty while doing the above. **Facilitating implementation**

				For example, expressing positivity, taking responsibility, action planning	(1) forming implementation plans and plans for overcoming obstacles, (2) acquiring resources and gaining support, (3) developing skills, (4) identifying opportunities for implementation and (5) activating, focusing and guiding implementation.
Monitoring checks on the progress and quality of the work; examines relevant sources of information to determine how well important tasks are being performed; evaluates the performance of members in a systematic way.	**Monitoring** Somebody monitors needs and requirements and controls the actions of others **Correcting** Somebody speaks up, intervenes, or corrects faulty actions or decisions made by others	**Task monitoring** Asking team members for and confirmation about (the progress on) their tasks clarification **Correcting** Imposing of disciplinary actions; Presenting team members with a "fait accompli"	**Observation** Recognizing or noting a fact or occurrence		
Problem solving identifies work-related problems that can disrupt operations, makes a systematic but rapid diagnosis, and takes action to resolve the problems in a decisive and confident way.	**Informing** Somebody verbalizes a problem, provides interpretation of a problem, or suggests a solution to a problem with the intention to influence others	**Informing** Giving factual information **Giving own opinion** Giving one's own opinion about what course of action needs to be followed for the organization, department or the team	**Answer** Supplying information for an inquiry	**Knowledge management** That is, sharing organizational information, questions about knowledge **Problem solving** For example, identifying a (partial) problem or solution, illustrating a problem or solution **Positive proactive behaviors** For example, expressing positivity, taking responsibility, action planning	**Facilitating implementation** (1) forming implementation plans and plans for overcoming obstacles, (2) acquiring resources and gaining support, (3) developing skills, (4) identifying opportunities for implementation and (5) activating, focusing and guiding implementation.
Supporting shows concern for the needs and feelings of individual members; provides support and				**Positive relation-oriented behaviors** For example, encouraging participation, providing	**Promoting cooperation** (1) encouraging individual contributions to the group's progress, (2) underlining these individual contributions and their uniqueness and indispensability to and

encouragement when there is a difficult or stressful task, and expresses confidence members can successfully complete it.			support, offering praise, expressing feelings	effect on collective progress, (3) encouraging and offering social support, (4) delegating individual tasks based on comprehensive work-role-fit regarding interests, competence, and values and (5) permitting autonomy in tasks to allow for self-determination. **Activating resources** (1) suggesting or instructing self-efficacy, (2) highlighting positive experiences, past successes, and feasible future accomplishments, (3) focusing positive attributes of individuals and the group as a whole, (4) fostering the expectation to collectively divert impending power losses or to achieve power gains and (5) rewarding and recognizing to call forth and shape future valuable contributions.
Developing provides helpful feedback and coaching for members who need it; provides helpful career advice; en- courages members to take advantage of opportunities for skill development.		**Individualized consideration** Paying attention to each individual's need for achievement and growth by acting as a coach or mentor and creating a supporting climate **Providing positive feedback** Positively evaluating and rewarding the behavior and actions of team members **Providing negative feedback** Criticizing the behaviors or actions of other team members	**Development planning** For example, direction of development, action planning of development **Performance evaluation** For example, providing performance evaluation (on a scale), describing performance evaluation	
Recognizing	**Recognizing others**	**Providing positive feedback**	**Positive relation-oriented behaviors**	**Activating resources**

praises effective performance by members; provides recognition for member achievements and contributions to the organization; recommends appropriate re- wards for members with high performance.	Somebody gives feedback to others	Positively evaluating and rewarding the behavior and actions of team members		For example, encouraging participation, providing support, offering praise, expressing feelings	(1) suggesting or instructing self-efficacy, (2) highlighting positive experiences, past successes, and feasible future accomplishments, (3) focusing positive attributes of individuals and the group as a whole, (4) fostering the expectation to collectively divert impending power losses or to achieve power gains and (5) rewarding and recognizing to call forth and shape future valuable contributions. **Promoting cooperation** (1) encouraging individual contributions to the group's progress, (2) underlining these individual contributions and their uniqueness and indispensability to and effect on collective progress, (3) encouraging and offering social support, (4) delegating individual tasks based on comprehensive work-role-fit regarding interests, competence, and values and (5) permitting autonomy in tasks to allow for self-determination.
Empowering involves members in making important work-related decisions and considers their suggestions and concerns; delegates responsibility and authority to members for important tasks and allows them to resolve work-related problems without prior approval.	**Delegating/ Decision-making** Somebody delegates tasks or roles to somebody else; **Consulting** Somebody asks others for their opinion	**Directing** Dividing tasks among team members (without enforcing them); Determining the current direction **Intellectual stimulation** Asking for ideas, stimulating team members to critically think about team tasks, opportunities and so on, including the questioning of assumptions; thinking about old situations in new ways	**Command** Specific request or demand for action		**Promoting cooperation** (1) encouraging individual contributions to the group's progress, (2) underlining these individual contributions and their uniqueness and indispensability to and effect on collective progress, (3) encouraging and offering social support, (4) delegating individual tasks based on comprehensive work-role-fit regarding interests, competence, and values and (5) permitting autonomy in tasks to allow for self-determination. **Activating resources** (1) suggesting or instructing self-efficacy, (2) highlighting positive experiences, past successes, and feasible future accomplishments, (3) focusing positive

Advocating change
explains an emerging threat or opportunity; explains why a policy or procedure is no longer appropriate and should be changed; proposes desirable changes; takes personal risks to push for approval of essential but difficult changes.
Envisioning change
communicates a clear, appealing vision of what could be accomplished; links the vision to member values and ideals; describes a proposed change or new initiative with enthusiasm and optimism.

Giving own opinion
Giving one's own opinion about what course of action needs to be followed for the organization, department or the team
Idealized influence behavior
Talking about an important collective sense of vision; Talking about important values and beliefs

attributes of individuals and the group as a whole, (4) fostering the expectation to collectively divert impending power losses or to achieve power gains and (5) rewarding and recognizing to call forth and shape future valuable contributions. **Fostering coordination**
(1) communicating the procedure explicitly and maintaining the structure of communication, (2) ensuring and communicating decisions, (3) employing standardized processes and (4) conveying personal competence and certainty while doing the above.
Strengthening motivation
(1) deliberating possible objectives and their consequences, (2) weighing the desirability of the alternative objectives, (3) deriving concrete intentions and (4) strengthening the motivation to pursue shared goals and individual goals that support the shared goals by focusing on the value of positive consequences, approval by relevant others and the motivation to comply with these relevant others.
Strengthening motivation
(1) deliberating possible objectives and their consequences, (2) weighing the desirability of the alternative objectives, (3) deriving concrete intentions and (4) strengthening the motivation to pursue shared goals and individual goals that support the shared goals by focusing on the value of positive consequences, approval by relevant others and the motivation to comply with these relevant others.

Encouraging innovation talks about the importance of innovation and flexibility; encourages innovative thinking and new approaches for solving problems; encourages and supports efforts to develop innovative new products, services, or processes.

Facilitating collective learning uses systematic procedures for learning how to improve work unit performance; helps members understand causes of work unit performance; encourages members to share new knowledge with each other.

Networking attends meetings or events; joins professional associations or social clubs; uses social networks to build and maintain favorable relationships with peers, superiors, and outsiders who can provide useful information or assistance.

External monitoring analyzes information about events, trends, and

changes in the external environment to identify threats, opportunities, and other implications for the work unit.

Representing
lobbies for essential funding or resources; promotes and defends the reputation of the work unit or organization; negotiates agreements and coordinates related activities with other parts of the organization or with outsiders.

Humor
Making jokes or funny statements

Laughing
Laughter or clearly humorous remark

Additional codes/fillers
Laughter, pause (> 5 seconds), non-comprehensible, interrupted sentences, external disturbance (e.g. phone rings)

Showing disinterest
Not taking any action (when expected)

Negative counteractive behaviors
For example, showing no interest in change, complaining, denying responsibility

Negative procedural behaviors
That is, running off-topic/losing the train of thoughts in details and examples

Defending one's own position
Emphasizing one's leadership position;

Negative relation-oriented behaviors

Emphasizing self-importance		That is, criticizing, interrupting, self-promotion
Interrupting Interfering or disturbing when other team members are talking		
Agreeing Agreeing with something; consenting with something		
Disagreeing Contradicting with team members	**Disagreeing** Response not in agreement with a previous statement	
	Anger Comment beyond mere disagreement, or a ridiculing remark	
Giving personal information Sharing personal information (e.g. about the family situation)		
Active listening Active listening		**Neutral relation-oriented behaviors** That is, listening
	Apologies Remark expressing sorrow or regret for prior action	
	Non-work Social non-task communication	
		Negative procedural behaviors That is, running off-topic/losing the train of thoughts in details and examples

Appendix C

Task-oriented behavior

Yukl (2012) describes objectives for every behavioral meta-category. For task-oriented behavior the objective is to manage work in such a way that it is executed in the most effective and reliant way. This meta-category includes clarifying, planning, monitoring operations and problem solving (Yukl, 2012). In addition to these, behaviors from the other taxonomies have been added to make the behaviors in this meta-category mutually exclusive and comprehensive.

These added behaviors are; structuring meetings (i.e. structuring the meetings; changing the topic; shifting towards the next: Hoogeboom and Wilderom, 2019), correcting (i.e. Somebody intervenes, or corrects faulty actions or decisions made by others; criticizing: Bienefeld & Grote, 2014; Hoogeboom & Wilderom, 2019), informing (i.e. giving factual information: Bienefeld & Grote, 2014; Hoogeboom & Wilderom, 2019), delegating (i.e. dividing tasks among team members (without enforcing them); delegates responsibility and authority to members for important tasks: Bienefeld & Grote, 2014; Behrendt et al., 2016; Hoogeboom & Wilderom, 2019), agreeing (i.e. agreeing with something; consenting with something: Waller & Philips, 2012; Hoogeboom & Wilderom, 2019) and disagreeing (i.e. contradicting with team members: Zijlstra et al., 2012; Hoogeboom & Wilderom, 2019).

The added behaviors were regarded task-oriented behavior, as they met the objectives of the task-oriented meta-category, formulated by Yukl (2012), because they were all behaviors that catalyze the process of task execution. Furthermore, they were classified as such in the study of origin.

Relations-oriented behavior

The objective of relations oriented behavior is to maintain and improve the quality of human capital, by means of positive relational behavior (Yukl, 2012). This includes the following behaviors (Yukl, 2012); supporting, developing, recognizing and empowering. When comparing this with other behavioral taxonomies, it was notable that the descriptions of behaviors by Yukl (2012) are somewhat extensive (i.e. a multitude of different behaviors). For that reason, some behaviors were specified and/or split into and replaced by more specific behaviors and categorized as

relation-oriented behaviors. The newly formulated behaviors met the objectives of the relations-oriented meta-category, formulated by Yukl (2012), because they were all behaviors that are related to interpersonal human interaction with the goal to engage employees on a personal level. Furthermore, they were classified as such in the study of origin.

After adding and splitting behaviors the following behaviors were defined in the relation-oriented meta-category; mental support (i.e. shows concern for the needs and feelings of individual members; provides support and encouragement when there is a difficult or stressful task, and expresses confidence members can successfully complete it: Behrendt et al., 2016; Meinecke et al., 2017), work related personal development planning (i.e. paying attention to each individual's need for achievement and growth by acting as a coach or mentor and creating a supporting climate; encourages members to take advantage of opportunities: Hoogeboom & Wilderom, 2019; Meinecke et al., 2017), empowering intellectual stimulation (i.e. somebody asks others for their opinion; involves members in making important work- related decisions and considers their suggestions and concerns: Behrendt et al., 2016; Bienefeld and Grote, 2014; Hoogeboom & Wilderom, 2019; Meinecke; Zijlstra et al., 2012), negative relation oriented behaviors (i.e. interrupting, self-promotion; Meinecke et al., 2017), neutral relation oriented behaviors (i.e. listening: Meinecke et al., 2017) and humor (i.e. laughter: Hoogeboom & Wilderom, 2019; Zijlstra et al., 2012).

Change-oriented behavior

Change-oriented behavior relates to behavior that increases innovation and collective learning, while taking into account and adapting to the external environment (Yukl, 2012). The behaviors in this meta-category are; advocating change, envisioning change, encouraging innovation and facilitating collective learning (Yukl, 2012). Other taxonomies did not include this meta-category or similar behavior, thus the meta-category 'change-oriented behavior' and its defined behaviors are included in our taxonomy as proposed by Yukl (2012).

Action oriented behavior

Meinecke et al. (2017) introduced two new meta-categories, namely action oriented behavior and procedural oriented behavior. Three behaviors in these categories were observable behaviors that were not addressed in the taxonomy of Yukl (2012). These behaviors are negative

counteractive behavior, negative procedural behavior and positive procedural behavior (Bienefeld & Grote, 2014; Meinecke et al., 2017; Hoogeboom & Wilderom, 2019), Because they did not match the objectives of task-, relations-, change-oriented behavior meta-categories, they were added in our taxonomy with the meta-category categorization set by the studies of origin.

The three behaviors are defined as follows; negative counteractive behavior (i.e. Showing no interest in change, complaining, denying: Meinecke et al., 2017; Hoogeboom & Wilderom, 2019), negative procedural behavior (i.e. running off-topic/losing the train of thoughts in details and examples; Meinecke et al., 2017) and positive procedural behavior (i.e. Somebody instructs others on how a task or procedure should be done: Meinecke et al., 2017; Bienefeld & Grote, 2014).

Appendix D

Table 2. Design aspects of the table-top simulation environment (Lo & Meijer, 2019)

Core Aspects	Description
Purpose	To study the impact of current and alternative procedures for the improvement of the speed and realization of railway infrastructure disruption mitigation
Scenarios	Two: 1. current procedure (routine), 2. alternative procedure (non-routine). The scenarios took place during peak hours and lasted 45 minutes
Simulated world	Railway system between Amsterdam Central Station and Alkmaar Station. Representation of train traffic flow on A0 foam board with schematic representation of the infrastructure, representation of train through pegs with information about train number and length of delay, automatic route setting simulated through facilitators. Train delays and status on national-wide corridors logged in a developed computer program. Timetable information provided on A4 sheets, Simulation of co-location by room separation
# of participants	12, excluding facilitator roles
Roles (#)	Train traffic controller (TTC) (4), regional network controller (RNC) (1), national network controller (NNC) (1), regional passenger traffic monitor (RPTM) (1), regional passenger traffic junction coordinator (RPTJC) (1), regional passenger traffic material and passenger coordinator (RPTMPC) (1), national passenger traffic controller (NPTC) (1), passenger information dispatcher (PID) (2). Facilitators took upon the roles of: train drivers (TD) responsible for passenger trains, train drivers responsible for shunting train, emergency coordinator (EC) and the back-office (BO)
Type of role	Similar or equal to their own roles
Objectives	Execution of tasks – same as in their daily work, only in scenario 2 with new procedures
Constraints	Inclusion of two regional traffic centers, exclusion of roles outside the defined infrastructure area, exclusion of train driver
Load	Two sequential medium impact disruptions; 1. train malfunction, 2. gas leak in a tunnel. These types of disruptions can be categorized as low to average in terms of frequency. Also, both disruptions may be interpreted within the same order magnitude / class of impact
Situation (external influencing factors)	Presence of individual observers seated next to or near the participant, facilitators, occasional attendance of observers from both railway organization
Time model	Continuous

Appendix E

Table 3. Frequency of performed behavior split per scenario

		Informal leader		Boundary spanners	
		Routine	non-routine	routine	non-routine
Task-oriented	Informing	**43.56%**	**41.01%**	36.27%	31.35%
	Clarifying	28.71%	**28.06%**	**32.87%**	25.81%
	Delegating	**13.86%**	**9.35%**	5.09%	3.51%
	Problem solving	**7.92%**	**8.63%**	3.86%	2.84%
	Planning	**4.95%**	**5.04%**	3.24%	2.57%
	Agreeing	-	-	**2.93%**	**0.81%**
	Monitoring	-	**4.32%**	**2.01%**	1.08%
	Disagreeing	-	-	**1.08%**	**0.81%**
	Correcting	-	-	**0.46%**	**0.54%**
	Structuring meetings	-	-	**0.15%**	**0.14%**
	Total	***99.01%***	***96.40%***	*87.96%*	*69.46%*
Relations-oriented	Humor	-	-	**1.08%**	**5.00%**
	Recognizing	-	-	**0.77%**	**0.27%**
	Empowering intellectual stimulation	-	-	**0.31%**	**0.54%**
	Mental support	-	**0.72%**	**0.15%**	0.27%
	Neutral relation-oriented behaviors	-	-	**0.15%**	**0.27%**
	Negative relation-oriented behaviors	-	-	**0.15%**	-
	Total	**-**	*0.72%*	***2.62%***	***6.35%***
Procedural behavior	Positive procedural behaviors	-	**1.44%**	**2.47%**	0.95%
Action-oriented	Negative counteractive behaviors	-	-	**0.93%**	**0.14%**
Additional	Additional codes/fillers	-	-	**-**	**0.14%**
Unclassified	Inquiry	-	0.72%	**2.01%**	**1.22%**
	Answer	-	**0.72%**	**1.39%**	0.68%
	Non-work/social	0.99%	-	**2.62%**	**21.08%**

Total	*0.99%*	*2.88%*	***9.41%***	***24.19%***
Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**
Total behaviors	**101**	**139**	**648**	**740**