CHAPTER 2
EFFECTIVENESS OF MULTITEAM SYSTEMS FOR MULTI-ORGANIZATIONAL COLLABORATION

ABSTRACT
Multiteam systems (MTSs) – or teams of teams – represent a new, increasingly common form to structure multi-organizational collaborations. The effectiveness of an MTS approach for multi-organizational endeavors remains, nevertheless, unclear. Whereas some scholars emphasize the advantages of MTSs, other scholars point to their disadvantages, suggesting that alternative, more centralized organizational structures might be more effective. This study aims to address this ambiguity by quantitatively examining the six-year performance of a multi-organizational collaboration that shifted from a more formalized and centralized structure towards an MTS approach. Additionally, qualitative findings from interviews and participant observations shed light on key mechanisms and boundary conditions for the effects of an MTS approach. Results illustrate key advantages and disadvantages associated with an MTS approach for multi-organizational collaboration; moreover, our findings highlight the importance of contingent coordination and cross-organizational understanding as critical contingency factors that determine the ultimate performance consequences of an MTS approach over more formalized and centralized structures.
Multi-organizational collaborations are common in today’s globalized and interrelated societies. Such arrangements, in which teams from multiple organizations work together towards joint objectives, are used to deal with a variety of complex tasks that would be impossible to accomplish by any single organization (Borys & Jemison, 1989; Marks, Mathieu, & Zaccaro, 2001; Waugh & Streib, 2006). Commercial firms, for example, use strategic alliances, outsourcing arrangements, and public-private partnerships for new product developments and large-scale projects, enabling them to better face intensified competition and shortened product-life cycles (Lambe & Spekman, 1997; Thomas & Griffin, 1996). Similarly, disaster recovery and military operations often require joint contributions from various governmental and non-governmental organizations, such as different military and police organizations, local and regional officials, volunteering groups, and medical rescue services (Kapucu, Arslan, & Collins, 2010; Shaw & Goda, 2004; Waugh & Streib, 2006).

Despite their pervasiveness, research has shown that many multi-organizational collaborations do not deliver their desired benefits, with more than half of all collaborative arrangements failing or ending prematurely (for a review, see Das & Teng, 2000). Scholars have identified misunderstandings and conflicts resulting from differences between partner organizations’ working methods and cultures as one of the main reasons for such failure, arguing that such issues may hinder effective coordination and the realization of collective goals (Granot, 1999; Lynch, O’Toole, & Biemans, 2014). Moreover, teams from different organizations often hold fundamentally different (commercial) goals and interests and strive to protect their autonomy and unique identity (Agranoff, 2006; Hanf & O’Toole, 1992; Van de Ven & Walker, 1984). These tendencies complicate attempts to integrate operations and share critical information required for collective task execution.

To overcome these problems, theorists have suggested to replace the bureaucratic structures that are typically used to coordinate the activities of teams from different
organizations with more decentralized and deformalized alternatives (Dynes, 1990; Takeda & Helms, 2006a; Waugh & Streib, 2006). Specifically, scholars have advocated a shift towards a “multiteam system” (MTS) approach to managing multi-organizational collaborations (Goodwin, Essens, & Smith, 2012; Mathieu, Marks, & Zaccaro, 2001: 290).¹ This approach aims to tightly couple teams from different organization, and facilitate these teams to self-manage collective efforts through informal, lateral coordination (Marks, DeChurch, Mathieu, Panzer, & Alonso, 2005; Zaccaro, Marks, & DeChurch, 2012). By implementing these principles, multi-organizational collaborations are believed to provide their teams with opportunities for directly resolving task-related ambiguities and conflicts with each other that may otherwise compromise collective performance (cf. Dynes, 1990; Takeda & Helms, 2006a; Waugh & Streib, 2006). Also, lateral coordination is thought to improve organizations’ access to each other’s capacities and resources, enabling them to better combine strengths when dealing with joint challenges (Mathieu et al., 2001).

It is important to note, however, that the MTS approach to multi-organizational collaboration has also been confronted with considerable skepticism. Some scholars have argued, for example, that an MTS’s informal and decentralized structure is not suitable for handling the distinctive complexity that characterizes multi-organizational collaborations (Provan & Milward, 1995). Individuals working within such complex collaborations may lack the time, resources, and capacities for informal and lateral adjustments, and they may therefore fail to recognize and act upon key coordination requirements (Davison et al., 2012; McGuire & Agranoff, 2011; Provan & Kenis, 2007). From this perspective, an MTS approach is unlikely to resolve multi-organizational collaborations’ key problems.

¹ MTSs can also be used to handle complex issues within a single organization (i.e., an internal MTS, comprising groups from a single organization). Our focus in this study is on MTSs that include teams from different organizations (i.e., so-called cross-boundary MTSs; Zaccaro et al., 2012).
Given the prevalence and relevance of multi-organizational collaborations, it seems vital to resolve this ambiguity. Can an MTS approach realize its potential benefits and, thus, offer a unique pathway towards multi-organizational collaborations’ success? Or will the potential problems associated with an MTS approach prevail, such that this approach fails to live up to its promise? Unfortunately, existing research provides little guidance toward answering these questions. Extant work on multi-organizational collaborations is mostly theoretical, and it explores organizational motives for engaging in such endeavors and for selecting specific structural forms (Albers, Wohlgezogen, & Zajac, 2013; Grandori & Soda, 1995; Gulati, 1998; for a review, see Provan & Kenis, 2007). Moreover, the few empirical MTS studies are experimental in nature and have focused on explicating key features that may render MTSs more or less successful (e.g., Davison et al., 2012; DeChurch & Marks, 2006; Lanaj, Hollenbeck, Ilgen, Barnes, & Harmon, 2013; Marks et al., 2005). What is missing, to date, is empirical research in real-life multi-organizational collaborations that (a) compares the effectiveness of an MTS approach versus alternative, more centralized and formalized structures, and (b) identifies the strategies members use to exploit the unique strengths of an MTS approach and cope with its weaknesses (McGuire & Agranoff, 2011; Provan, Fish, & Sydow, 2007; Provan & Kenis, 2007).

One way to address these issues would be to collect and compare data from a large number of multi-organizational collaborations that employ different organizational forms, including both MTSs and alternative approaches (Provan & Kenis, 2007). Collecting such data is extremely difficult (if not impossible), however, because multi-organizational collaborations typically constitute complex, large-scale entities that work on highly specialized tasks, under very specific circumstances, and with distinct effectiveness criteria that do not lend themselves to easy comparison (Gulati, 1998; Provan & Milward, 2001). For that reason, we adopted an alternative approach, using an interrupted time-series design to
examine the daily effectiveness of a multi-organizational collaboration responsible for incident management in the Dutch railway system. During the six-year period covered in the present research, this collaboration switched from a more traditional, centralized and formalized structure toward an MTS approach, resulting in a natural experiment that offered the unique opportunity to quantitatively examine the longitudinal effects of this change on objective performance outcomes (Shadish, Cook, & Campbell, 2001). Moreover, we gathered qualitative data through interviews and direct observations, providing rich insights into the specific functioning of the multi-organizational collaboration. Based on this longitudinal multi-method data, we developed a novel theoretical model that explicates why and when multi-organizational collaborations may (or may not) benefit from utilizing an MTS approach. As such, this study advances novel insights for the literature on both multi-organizational collaborations in general and MTSs in particular, paving the way for new studies on these important yet under-examined organizational forms.

**MTSs AND MULTI-ORGANIZATIONAL COLLABORATION**

MTSs represent a contemporary structural form for multi-organizational collaboration (Mathieu et al., 2001; Zaccaro et al., 2012). Within an MTS, teams from different organizations are arranged in a tightly coupled and interdependent manner, such that teams share task constraints (e.g., they operate in the same area or jointly use a limited resource base) and critically depend on each other’s support, information, and expertise for effective task execution (Zaccaro et al., 2012). To facilitate collective activities within this interrelated working context, MTSs typically feature a distal, overarching system-level goal that ties together teams’ and organizations’ more proximal goals (Marks et al., 2005; Mathieu et al., 2001). This hierarchical goal structure is believed to resolve incompatibilities between different teams’ potentially conflicting interests, providing them with tangible incentives for collaborative task accomplishment (Mathieu et al., 2001; see also Beck & Plowman, 2014).
Moreover, whereas more traditional structural forms for multi-organizational collaborations often rely heavily on centralized leadership and standardized protocols (cf. Schneider, 1992; Takeda & Helms, 2006b; Waugh & Streib, 2006), MTSs draw primarily on direct, ongoing mutual adjustments between different teams for realizing collective goals (Mathieu et al., 2001). Rather than exhibiting hierarchical control over the MTS as a whole, supervisory roles therefore serve supportive functions, enabling lower-level team members to directly coordinate with each other and self-manage joint efforts. Similarly, formal protocols and procedures remain deliberately limited and flexible to enable adaptive cooperation (DeChurch & Marks, 2006; Mathieu et al., 2001).

The multi-organizational collaborations frequently used for emergency response tasks (e.g., to cope with severe traffic accidents) are instructive to illustrate these MTS features. In these collaborative entities, teams of police officers, fire fighters, and paramedics attending to a crash site are directed towards unified rescue operations by their common goal of saving victims (DeChurch & Mathieu, 2009). These teams work closely together, providing mutual assistance and making collaborative decisions (DeChurch & Mathieu, 2009). On-site supervisors largely confine themselves to assisting members with advice and resources when needed, and formal procedures leave considerable leeway on how to collaborate in a specific situation.

Potential Advantages of an MTS Approach

Existing theory offers two fundamentally different perspectives on the potential performance consequences of an MTS approach for multi-organizational collaborations. Advocates of the approach draw from structural contingency theory (Hollenbeck et al., 2002; Pennings, 1975), which suggests that organizational structures vary in their built-in capacity for coordinating complex tasks. This capacity needs to match the complexity of an organization’s actual task environment to enable effective goal achievement (Lawrence &
Lorsch, 1967; Thompson, 1967; Tushman & Nadler, 1978). When tasks are highly complex, dynamic, and unpredictable, the capacities of a centralized body for overseeing and arranging all necessary alignments between interdependent teams are likely to be exhausted. As a result, it becomes virtually impossible to make centralized decisions or devise adequate formal rules and procedures for all relevant task contingencies (Galbraith, 1974). In these situations, structural contingency theory points to the benefits of flattened structures with direct, decentralized, and informal coordination between the parties involved (Pennings, 1975). Such structures may provide the mechanisms needed for effectively tapping into lower-level members’ combined capacities for analyzing and coordinating collective, complex tasks (Galbraith, 1974; Tushman & Nadler, 1978).

Building on structural contingency theory, some scholars have encouraged informal and decentralized structures for promoting multi-organizational performance (Goodwin et al., 2012; Mathieu et al., 2001; Waugh & Streib, 2006). Blurred boundaries between highly interdependent yet autonomous teams from different partner organizations, each with diverse characteristics, goals, and interests, create an exceptionally intricate and unpredictable environment for multi-organizational collaborations (Brusoni, Prencipe, & Pavitt, 2001; Huxham, Vangen, & Eden, 2000). As a result, teams may need to self-manage such complex collaborations through direct adjustments and consensual decision-making, because the coordination capacities of a centralized leadership team are likely to be overstretched in such situations (Albers et al., 2013; Waugh & Streib, 2006). Consistent with this perspective, initial experimental studies have illustrated that teams’ lateral coordination within MTS structures positively relates to MTSs’ performance (e.g., DeChurch & Marks, 2006; Marks et al., 2005).

**Potential Disadvantages of an MTS Approach**

In contrast, other theorists have emphasized the potential disadvantages of decentralized and informal structures for managing complex and unpredictable situations
during multi-organizational collaborations. These researchers have noted that it may be exceptionally challenging and, thus, inefficient to achieve collective outcomes through direct and informal adjustments (Huang & Provan, 2007; Provan & Milward, 1995, 2001). For example, decentralized teams may be ill-positioned to oversee all activities within the system and, correspondingly, they are likely to ignore important system-wide consequences of their dyadic coordination efforts, disrupting collective action within the multi-organizational collaboration as a whole (Klein & Pierce, 2001; Provan & Kenis, 2007). In addition, lateral coordination necessitates members to discuss and align efforts directly with each other, which may be impractical and inefficient for organizing system-wide activities that require input from many teams within a large collaboration (Provan & Kenis, 2007). Finally, interteam coordination typically represents an effortful extra-role activity for decentralized members. Such activities may be at odds with members’ more proximal responsibilities, such as realizing one’s own immediate goals, causing role overload and loss of commitment toward the multi-organizational collaboration as a whole (McGuire & Agranoff, 2011; see also Ancona & Caldwell, 1988; Faraj & Yan, 2009; Ramarajan, Bezrukova, Jehn, & Euwema, 2011).

Considering these potential downsides, some theorists have argued that the MTS approach should be ineffective for complex and unpredictable multi-organizational collaborations (Huang & Provan, 2007; Provan & Milward, 2001; McGuire & Agranoff, 2011). A few initial studies appear to support this perspective. Provan and Milward (1995), for example, found that intricate, multi-organizational healthcare collaborations were evaluated more positively when a centralized coordinating agency mediated the provision of services by multiple, separate organizations. Similarly, recent experimental research suggests that the importance of informal and lateral coordination within MTSs may have been
overstated, with decentralized members’ attempts to align activities through informal mutual adjustments actually damaging MTS performance (Davison et al., 2012; Lanaj et al., 2013).

Taken together, uncertainty exists regarding the ultimate performance implications of an MTS approach for multi-organizational collaborations, and about key mechanisms through which these performance implications may emerge. Some scholars suggest that an MTS approach may enable organizations to effectively draw from each other’s resources and capacities, thereby increasing their collective performance. Other scholars doubt whether such advantages can actually be realized. Multi-organizational collaborations may be too complex to be effectively organized through decentralized members’ lateral adjustments, and an MTS approach may, consequently, obstruct multi-organizational goal attainment.

Below, we report the results of a multi-method, multi-source study that aims to resolve these conflicting perspectives. Specifically, we use a combination of quantitative and qualitative research methods to examine a multi-organizational collaboration that has shifted from a more formalized and centralized structure towards an MTS approach, investigating both performance consequences and process dynamics associated with this change.

**METHOD**

**Research Setting**

The present study examines the relative effectiveness of an MTS approach for multi-organizational collaboration in a specific context, namely the management of incidents in the Dutch national rail network. The Dutch state has privatized the exploitation of this network and appointed a commercial company (ProRail) to manage it. Several independent passenger carriers, freight transporters, and other rail-related organizations operate on the network, employing more than 6,000 trains and carriages that travel approximately 150 million kilometers annually on a total track length of about 7,000 kilometers (ProRail, 2012). As such, the Dutch rail network is the densest in Europe (Ramaekers, de Wit, & Pouwels, 2009);
it is important for both the European and Dutch economy, facilitating the distribution of around 40 million tons of cargo each year (ProRail, 2013). In addition, trains represent a primary means of transportation for daily commuters in the Netherlands, with 92% of all trains carrying passengers and passengers travelling an annual 17 billion kilometers (Netherlands Railways, 2012; Ramaekers et al., 2009).

The Dutch rail network faces around 3,000 incidents each year, resulting, for example, from accidents, safety threats, bad weather conditions, and train or infrastructure breakdowns (Goodwin et al., 2012). This includes minor problems disturbing only a specific route, but also major incidents that paralyze substantial parts of the network. Resolving these incidents is – by necessity – a multi-organizational activity (van Aggelen, 2011). Rerouting trains, for example, requires carriers to align their efforts with each other and with Prorail to optimize network utilization and prevent conflicting train movements (Goodwin et al., 2012). In addition, alternative train movements need to be synchronized with the activities of infrastructure, information technology, and train repair organizations.

This multi-organizational collaboration is complicated by pronounced differences in working methods, technical systems, and resources, as well as by competing interests across relevant organizations (Goodwin et al., 2012). Passenger carriers, for example, are legally obliged to reimburse passengers in case of large delays, and freight carriers face financial penalties when missing delivery times. Hence, both of these parties tend to demand priority for their trains in incident situations, creating inter-organizational conflicts and potentially hampering coordination. Similarly, passenger carriers typically prefer major rail repairs to be conducted outside commuters’ rush hours – which conflicts with freight carriers’ main operating times.

Over the years, the multi-organizational structure set up to effectively orchestrate rail incident management in the Netherlands has changed dramatically. Until October 2010,
coordination between different organizations was strictly formalized and relied on highly
standardized procedures that pre-specified different organizations’ roles. Moreover, ProRail
traffic controllers decided on how to resolve complex rail incidents that existing procedures
did not sufficiently cover, providing specific instructions to carriers and repair organizations.
In doing so, traffic controllers’ main focus was on realizing relatively proximal goals, such as
rerouting trains and resolving immediate logistical disturbances within local parts of the rail
network (Goodwin et al., 2012; van Aggelen, 2011). During this period, traffic controllers,
carriers, and repair organizations all operated from different working locations, and their
members had little opportunity for direct contact with each other. In fact, the primary means
of inter-organizational contact was through a shared electronic information system maintained
by a centralized back office. Consequently, the different organizations involved in nation-
wide rail incident management had relatively little regard for each other’s specific needs and
for their actions’ potential ramifications for the network as a whole (Goodwin et al., 2012).

After a series of incidents in 2005, administrators of different rail organizations
concluded that incident management could benefit from more intensive and direct
cooperation, as well as from a more comprehensive, nation-wide focus (van Aggelen, 2011).
In 2007, administrators therefore initiated a new concept for incident management, based on
the MTS approach towards multi-organizational collaboration that had gained popularity at
the time. This resulted in the installation of the “Operational Control Center Rail” (OCCR), a
24/7 command-and-control center that became fully operational in October 2010. The OCCR
functions as an open platform that allows teams from different rail-related organizations to
discuss and organize collective responses to rail incidents within a collocated facility.
Participation is open to all rail-related organizations, but it entails sharing in the operating
cost of the OCCR. In total, 300 members from thirteen teams, representing seven
organizations, work in shifts in the OCCR (see Table 2.1 for an overview). An additional
team of five impartial “national rail coordinators” is financed collectively by all participating organizations to stimulate and facilitate inter-organizational coordination. Teams occupy specified sections in the OCCR’s open-spaced control room, providing their members with separate working areas while also placing them in direct line of sight with teams from other organizations (see Figure 2.1).

With the implementation of the OCCR, participating organizations became jointly responsible for minimizing incident effects on nation-wide train services, and teams from separate organizations were encouraged to engage in direct coordination and consensual decision-making within the shared control center. Consequently, traffic controllers’ previous centralized role disappeared, and information exchange between distinct organizations no longer required back office mediation. Consistent with an MTS approach, rail incidents were resolved through informal, direct inter-organizational adjustments rather than strict centralization and standardization (Goodwin et al., 2012; van Aggelen, 2011). In addition, organizations’ commercial goals were aligned to a large extent within the OCCR by emphasizing shared, overarching objectives for teams from distinct organizations (i.e., reducing rail incidents’ consequences for the national rail network as a whole).
## TABLE 2.1

**Organizations and Teams Participating in the OCCR**

<table>
<thead>
<tr>
<th>Organization</th>
<th>Team</th>
<th>Role within OCCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>OCCR</td>
<td>National Rail Coordinators</td>
<td>Facilitating inter-organizational coordination between teams in the OCCR.</td>
</tr>
<tr>
<td>ProRail</td>
<td>Rail Traffic Control</td>
<td>Re-allocating railroad routes to carriers when the capacity of the rail network is reduced.</td>
</tr>
<tr>
<td></td>
<td>Back Office</td>
<td>Registering activities of different teams during incidents in a central logging system.</td>
</tr>
<tr>
<td></td>
<td>Asset Management</td>
<td>Organizing and overseeing repairs, renewal, and maintenance of rail infrastructure (e.g., tracks, signaling systems, power supply, structures).</td>
</tr>
<tr>
<td></td>
<td>Central Service Desk</td>
<td>Organizing repairs, renewal, and maintenance of rail-related information technology used for providing traveller information and network management.</td>
</tr>
<tr>
<td>Netherlands Railways</td>
<td>Traveller Information</td>
<td>Informing travellers of adjusted train schedules.</td>
</tr>
<tr>
<td></td>
<td>Allocation Center</td>
<td>Planning and rerouting passenger trains, carriages, and staff in the rail network.</td>
</tr>
<tr>
<td></td>
<td>Passenger Services</td>
<td>Maintaining continuance of passenger transport by, for example, arranging alternative transport.</td>
</tr>
<tr>
<td>NS Hispeed</td>
<td>Planning and rerouting international, high speed trains.</td>
<td></td>
</tr>
<tr>
<td>BAM</td>
<td>BAM Rail</td>
<td>Executing emergency repairs on rail-infrastructure for a designated part of the rail network.</td>
</tr>
<tr>
<td>Strukton</td>
<td>Strukton Rail</td>
<td>Executing emergency repairs on rail infrastructure in remaining parts of the rail network.</td>
</tr>
<tr>
<td>Volker</td>
<td>Volker Rail</td>
<td>Executing large-scale renewal and maintenance in the rail network.</td>
</tr>
<tr>
<td>Nedtrain</td>
<td>Executing emergency repairs for broken-down trains.</td>
<td></td>
</tr>
<tr>
<td>DB Schenker</td>
<td>DB Schenker</td>
<td>Planning and rerouting cargo transport.</td>
</tr>
</tbody>
</table>

31
FIGURE 2.1

The Operational Control Center Rail

Source: Operational Control Center Rail, reproduced with permission from copyright holder.
Data Collection

We conducted the present research in two phases, namely a quantitative phase aimed at highlighting performance implications of an MTS approach towards multi-organizational collaboration, as well as a qualitative phase aimed at clarifying the specific mechanisms and boundary conditions underlying these implications. Scholars have argued that such distinct methodologies “can be combined successfully in cases where the goal is to … generate greater understanding of the mechanisms underlying quantitative results” (Edmondson & McManus, 2007: 1157). Hence, this multi-method, multi-source research design seems particularly appropriate for the present purposes.

**Quantitative phase.** In the quantitative phase, we examined objective performance data on daily incident management using an interrupted time-series methodology (McCleary & Hay, 1980; Shadish et al., 2001; Tabachnick & Fidell, 2007). These data consisted of 2,029 daily observations, spanning from January 2007 to August 2012, retrieved from an official electronic information system used to record and store important information on incidents within the Dutch railway network. This system is accessible by all relevant rail-related organizations and has been used continuously over the years to register the type, location, and progress of all incidents in the network. The system is an important source of information during incident management and information is therefore entered with great care for accuracy and consistency.

**Qualitative phase.** The qualitative phase of the study drew on archival data (e.g., incident procedures, legal information, etc.) as well as three separate one-week periods of on-site data collection. First, in May 2011, we conducted unstructured interviews with 19 OCCR members. One of the national rail coordinators identified these members as being particularly knowledgeable about incident management within the rail sector, and they represented all major OCCR teams. The purpose of these interviews was to better understand the functioning
of the OCCR and to get first insights into how the transition from a more centralized and formalized structure to an MTS approach had affected multi-organizational incident management.

Second, in June 2011, we conducted participant observations at the OCCR (supplementing less systematic observations during the other periods of qualitative data collection). The first authors spent a full working week at the OCCR, witnessing the management of more than 50 incidents that ranged from relatively small (e.g., a minor collision) to very large (e.g., a technical malfunction disrupting all train movements surrounding an international airport). One of the national rail coordinators provided assistance during the observation period, explaining important phenomena and processes as they unfolded during various incident management situations. We made extensive field notes and, whenever possible, asked OCCR members to further explicate their decisions and actions.

Third, in February 2013, the first author conducted semi-structured interviews with key informants at the OCCR. Using insights from the unstructured interviews and participant observations, we developed an interview protocol aimed at gaining more precise knowledge about how the MTS approach had affected multi-organizational incident management. One of the national rail coordinators provided feedback on the protocol’s clarity and applicability and helped us to identify 13 OCCR members that had not participated in the unstructured interviews and had extensively experienced both the earlier centralized and formalized structure and the current MTS approach. These interviewees included representatives from Traveller Information, Passenger Services, the Allocation Center, Nedtrain, Rail Traffic Control, Back Office, Asset Management, Central Service Desk, and the National Rail Coordinators. All interviewees were asked to describe if and how incident management had changed after the implementation of the OCCR. Respondents also indicated whether additional changes to incident management had been made in 2010 (other than the OCCR
implementation), to identify potential alternative explanations for our quantitative results (see Appendix for interview questions). Interviews took, on average, 1-1.5 hours, resulting in 20 hours of recorded interview material. All interviews were transcribed, resulting in about 150 pages of single-spaced interview data.

**Quantitative Measures**

**Multi-organizational performance.** Administrators of various different organizations involved in rail incident management indicated that the multi-organizational collaboration’s performance is primarily reflected in the speed of incident resolution. Hence, we used the electronic information system mentioned before to obtain starting points (time and date at which an incident was first identified) and end points (time and date at which affected tracks were again released for normal traffic) for all rail incidents that had occurred in the period from January 2007 to August 2012 (i.e., over 20,000 individual incidents). We calculated daily mean durations for these incidents to create a complete time series comprising 2,029 daily criterion values. A daily criterion value represents the average duration of all rail incidents that had started on that day (in minutes), irrespective of these incidents’ end points. Higher values indicate that it took more time, on average, to resolve rail incidents, and therefore denote lower performance. Standardized residual plots suggested that normality assumptions were violated. Following McCleary and Hay's (1980) recommendations, we therefore log-transformed criterion values.

**Covariates.** We obtained data from the electronic information system about external conditions that could have influenced durations of rail incidents and, therefore, should be considered as covariates. Specifically, we gathered information on the number and severity of rail incidents that had occurred during any day in the study period. Rail incidents are classified in the information system according to severity: *Type-A incidents* denote small disturbances (e.g., local power outages), *Type-B incidents* have medium severity (e.g.,
derailments without casualties), Type-C incidents are large-impact incidents (e.g., derailments with casualties), and Type-D incidents are extreme in impact (e.g., complete shutdown of vital infrastructure control systems, large fires in tunnels or stations). To account for differences between these incident types, we controlled for the number of times each incident type had occurred during a day. We also calculated simultaneous incidents, which denoted the number of incidents that overlapped on any given day. Informants stated that overlapping incidents substantially increased work pressure and complicated incident management. Furthermore, interviewed employees noted that incidents lasted longer during weekends, because repair crews are not on the job and need to be called in. We therefore incorporated a dummy variable weekend, indicating whether a specific day was a workday (0) or on the weekend (1).

Analysis

Quantitative data analysis. Dutch law divides the national rail network into two parts that are managed separately (Dutch Railway Act of 2003). The “core rail network” comprises all vital passenger rail routes that connect important cities and enable long-distance travelling, whereas the “peripheral rail network” consists of all remaining network parts. Core and peripheral rail networks operate largely independently from each other, such that (a) no passenger train movements are allowed between peripheral and core parts, (b) different carriers operate on these distinct parts, and (c) peripheral parts fall under the jurisdiction of regional governments rather than the national government. Correspondingly, incident management is conducted separately for the core and peripheral network parts. Importantly, whereas the core network shifted to an MTS approach for incident management in 2010, the peripheral network continued to use more centralized and formalized structures during the entire study period. We therefore calculated separate time series on daily incident duration for the core and peripheral rail networks. This enabled us to compare the effectiveness of multi-organizational incident management in the core network before and after the switch to an
MTS approach, as well as to contrast the core and peripheral networks’ respective performance outcomes.

We used interrupted time-series analyses to examine the MTS approach’s effects. Interrupted time-series analyses represent a quasi-experimental methodology that allows for hypothesis testing when longitudinal criterion values have been collected during a pre- and post-intervention period (Cascio & Aguinis, 2006; Cook & Shadish, 1994). It involves reducing serial correlations within a time series such that assumptions of non-independence between data points are not violated (McDowall, McCleary, Meidinger, & Hay, 1980; Yaffee & McGee, 2000). To achieve this, researchers need to employ an iterative process that identifies a so-called autoregressive-integrated-moving-averages (ARIMA) model that fits with the time series data (Box & Jenkins, 1976; McDowall et al., 1980). An ARIMA model can include autoregressive functions (AR) to control for correlations between adjacent data points (e.g., an autoregressive function with a lag of one \(AR_{t-1}\) in a daily time series controls for the dependencies between a daily value and its direct predecessor) as well as moving average functions (MA) to control for correlations between adjacent data points’ random components (Tabachnick & Fidell, 2007). A non-significant Ljung-Box statistic indicates that there is no remaining serial dependency and, thus, that the identified ARIMA model appropriately fits the data (Tabachnick & Fidell, 2007).

In the first step of the present analyses, we used simple interrupted time series analysis in the core network to assess whether the shift towards an MTS approach had affected multi-organizational performance. We identified an ARIMA model with \(AR_{t-1}\) and \(MA_{t-1}\) functions as best fitting our data. This model effectively controlled serial correlations (Ljung-Box \(Q = 12.41, df = 16, n.s.\)). Following McCleary and Hay (1980), we subsequently compared core network incident management performance before and after the introduction of the MTS approach by adding a scale (\(\delta\)) and a rate parameter (\(\omega\)) to the ARIMA model. Significance of
the scale parameter indicates that the intervention can be reliably associated with a performance change. Further, the rate parameter indicates the trajectory of such change, with values close to zero suggesting that effects occurred abruptly after the intervention (in our case, the shift towards the MTS approach) and values close to 1 indicating that intervention effects emerged gradually over time (McCleary & Hay, 1980; McDowall et al., 1980; Yaffee & McGee, 2000).²

Importantly, however, simple interrupted-time-series analyses do not enable formal statistical comparison of multiple time series, as is needed to contrast multi-organizational performance changes across the core and peripheral rail networks. Hence, we merged core and peripheral network data into one pooled time series. We then created a group dummy variable that indicated if values reflected performance within the peripheral (0) or core network (1). Further, we created a period dummy, denoting whether values reflected performance before (0) or after (1) October 2010, when the core rail network had shifted to an MTS approach. Based on this combined data set, we used generalized linear modeling for pooled cross-sectional time series to assess whether there was indeed a significant change in multi-organizational performance following the shift to the MTS approach in the core network, relative to the peripheral network as a control group.

**Qualitative data analysis.** Our analysis of the qualitative data followed an iterative process (Eisenhardt & Graebner, 2007). Based on the unstructured interviews and participant observations, we identified potentially important inter-organizational processes and phenomena that appeared likely to be altered by the shift towards an MTS approach (cf. Isabella, 1990). We translated these insights into a preliminary list of categories that we crosschecked against the unstructured interviews and observation notes, omitting categories

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² As recommended by McCleary and Hay (1980), we checked for the influence of outliers with the outlier-detection function in time series analysis. We identified six outliers in the time series for the core rail network and four outliers in the time series for the peripheral rail network. Results remained virtually unchanged when we excluded these outliers. Hence, we report results based on the complete time series, including outliers.
that seemed insufficiently substantiated, combining similar categories, and adding categories to account for newly acquired insights. This multi-step process resulted in a refined category list (including operational definitions for each category; Beck & Plowman, 2014) that we subsequently used to interpret the semi-structured interview data.

We systematically and thoroughly inspected all transcripts from the semi-structured interviews for verbatim statements corresponding to the pre-identified categories. Moreover, we reanalyzed statements that could not be linked to these categories for patterns and common topics, in order to complement the category list. To allow for easy extraction of statements related to particular categories for further analysis, we coded interview statements using the Text Analysis Mark-up System software package (Weinstein, 2006). This allowed for the easy extraction of statements related to particular categories for further analysis. To ensure the reliability of the coding procedure, and following the procedure outlined by Isabella (1990), an independent rater blind to the research questions coded 40 randomly selected statements (approximately 25% of all statements) using our coding scheme and operational definitions. This resulted in a 78% interrater agreement score, thereby providing evidence for the accuracy of the coding procedures.

Next, we searched for broader patterns in the interview data by considering connections and similarities between coding categories (Beck & Plowman, 2014; van Maanen, 1979). Based on this information, we identified four higher-order categories from our coding scheme. We then reanalyzed the transcripts to assess how these higher-order categories related to each other and to multi-organizational performance (Beck & Plowman, 2014). To do so, we reread the categorized statements to detect patterns and processes that linked higher-order categories with each other (Isabella, 1990). After triangulating these outcomes with our initial field notes and unstructured interviews, we integrated this information into an inductive model describing process and performance implications of the
shift towards an MTS approach. We crosschecked this model with the expert opinions of one of the managers who had been involved in the OCCR development. This final step did not lead to any major model revisions and, thus, corroborated the viability of our conclusions.

**RESULTS**

**Quantitative Findings**

Table 2.2 presents means, standard deviations, and bivariate correlations based on the pooled time series data for both the core and peripheral rail networks. All covariates were significantly related with multi-organizational performance, illustrating the relevance of controlling for these factors (cf. Becker, 2005). Also, multi-organizational performance was significantly and negatively correlated with the period dummy variable ($r = -.09$, $p < .01$), suggesting that multi-organizational performance was, in general, higher in the period that followed the shift towards an MTS approach. Given the non-independence of the time-series data, however, these correlations should be interpreted with caution (Tabachnick & Fidell, 2007).
### TABLE 2.2
Descriptive Statistics

<table>
<thead>
<tr>
<th>Variables</th>
<th>M</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Incident Type A</td>
<td>2.22</td>
<td>2.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Incident Type B</td>
<td>1.67</td>
<td>2.12</td>
<td>.51**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Incident Type C</td>
<td>1.08</td>
<td>1.26</td>
<td>.32**</td>
<td>.37**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Incident Type D</td>
<td>.05</td>
<td>.23</td>
<td>.11**</td>
<td>.13**</td>
<td>.09**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Simultaneous Incidents</td>
<td>2.29</td>
<td>1.89</td>
<td>.43**</td>
<td>.45**</td>
<td>.36**</td>
<td>.11**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Weekend</td>
<td>.29</td>
<td>.45</td>
<td>-.12**</td>
<td>-.17**</td>
<td>-.14**</td>
<td>-.04*</td>
<td>-.19**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Region</td>
<td>.50</td>
<td>.50</td>
<td>.57**</td>
<td>.55**</td>
<td>.31**</td>
<td>.12**</td>
<td>.16**</td>
<td>.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Period</td>
<td>.33</td>
<td>.47</td>
<td>.18**</td>
<td>.10**</td>
<td>.08**</td>
<td>.03*</td>
<td>.20**</td>
<td>.02</td>
<td>.00</td>
<td></td>
</tr>
<tr>
<td>9 Multi-organizational</td>
<td>-2.68</td>
<td>.75</td>
<td>.14**</td>
<td>.10**</td>
<td>.08**</td>
<td>.04*</td>
<td>.10**</td>
<td>.04**</td>
<td>.12**</td>
<td>-.09**</td>
</tr>
</tbody>
</table>

Note: N = 3,741 to 4,058 daily observations due to missing values;

* p < .05; ** p < .01

1 Values are logarithmically transformed.
Results of the simple interrupted time series analysis in the core network showed significant effects for the intervention scale ($\omega = -.003$, $SE = .001$, $p < .05$) and rate parameters ($\delta = .991$, $SE = .004$, $p < .01$), as illustrated in Table 2.3. The negative scale parameter ($\omega$) indicates that the change towards an MTS approach was associated with a permanent decrease in daily incident duration within the core rail network (i.e., higher multi-organizational performance). Moreover, with the rate parameter ($\delta$) approaching one, it appears that this permanent reduction was asymptotic and gradual, rather than abrupt (McCleary & Hay, 1980). In other words, rail incidents’ daily average duration continued to gradually drop after the implementation of the MTS approach, but it did so in smaller and smaller steps over time. Overall, the model indicates an ultimate decrease of 30% in average daily incident duration; with a daily mean incident time of 144 minutes prior to the intervention, this equals an approximate 43-minute improvement within the core rail network.

ARIMA analyses further indicated that 99 percent of this performance improvement was realized within 472 days after MTS implementation (McCleary & Hay, 1980). In contrast, a separate simple interrupted-time-series analysis for the peripheral rail network showed that multi-organizational performance did not increase within this network part after the core network had shifted to an MTS approach ($\omega = -.065$, $SE = .593$, n.s.; $\delta = .467$, $SE = 4.902$, n.s.; see the right side of Table 2.3).

As outlined before, we used generalized linear modeling to statistically contrast the performance developments of the core and peripheral networks, regressing multi-organizational performance on study covariates, main effects, and the multiplicative region×period interaction effect (while controlling for serial dependencies using the ARIMA model described earlier; cf. Murray & Gerhart, 1998). As shown in Table 2.4, a significant

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4 Following McCleary and Hay (1980), we calculated this value using the following formula: Percentage change $= 1 - e^{\omega/(1 – \delta)} = 1 - e^{-.357} = .30$. 

42
region-by-period interaction suggests that the core and peripheral rail networks differed significantly in terms of multi-organizational performance for the period following the shift to an MTS approach, relative to their prior performance ($B = -.15$, $SE = .02$, $p < .01$). Graphical examination of the raw performance time series of the core and peripheral rail network illustrates these findings; as Figure 2.2 shows, the duration of rail incidents declined in the core rail network after the MTS approach’s implementation, and this decline was substantially stronger than in the peripheral network.

**TABLE 2.3**

Simple Interrupted Time Series Analysis for Multi-Organizational Performance within the Core and Peripheral Rail Networks

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Core Network</th>
<th>Peripheral Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>4.515 (.032)**</td>
<td>4.313 (.044)**</td>
</tr>
<tr>
<td>$AR_{t-1}$</td>
<td>.818 (.275)</td>
<td>-.256 (.433)</td>
</tr>
<tr>
<td>$MA_{t-1}$</td>
<td>.802 (.286)</td>
<td>-.311 (.426)</td>
</tr>
<tr>
<td>Incident Type A</td>
<td>.004 (.007)</td>
<td>.109 (.019)**</td>
</tr>
<tr>
<td>Incident Type B</td>
<td>-.033 (.007)**</td>
<td>.091 (.025)**</td>
</tr>
<tr>
<td>Incident Type C</td>
<td>-.010 (.011)</td>
<td>.061 (.023)**</td>
</tr>
<tr>
<td>Incident Type D</td>
<td>.025 (.047)</td>
<td>.079 (.138)</td>
</tr>
<tr>
<td>Simultaneous Incidents</td>
<td>.121 (.012)**</td>
<td>-.017 (.012)</td>
</tr>
<tr>
<td>Weekend</td>
<td>.107 (.031)**</td>
<td>.132 (.048)**</td>
</tr>
<tr>
<td>Intervention scale ($\omega$)</td>
<td>-.003 (.001)*</td>
<td>-.065 (.593)</td>
</tr>
<tr>
<td>Intervention rate ($\delta$)</td>
<td>.991 (.004)**</td>
<td>.467 (4.902)</td>
</tr>
<tr>
<td>Stationary R-Square</td>
<td>.093**</td>
<td>.040**</td>
</tr>
<tr>
<td>Ljung-Box Q (df)</td>
<td>11.023 (16)</td>
<td>17.250 (16)</td>
</tr>
</tbody>
</table>

*Note: $N = 1,722$ (peripheral rail network) to 2,019 (core rail network) daily observations;  
* $p < .05$; ** $p < .01$.  

43
<table>
<thead>
<tr>
<th>Variable</th>
<th>Multi-organizational performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>4.39 (.03)**</td>
</tr>
<tr>
<td>Incident Type A</td>
<td>.04 (.02)**</td>
</tr>
<tr>
<td>Incident Type B</td>
<td>.00 (.02)</td>
</tr>
<tr>
<td>Incident Type C</td>
<td>.02 (.02)</td>
</tr>
<tr>
<td>Incident Type D</td>
<td>.06 (.02)**</td>
</tr>
<tr>
<td>Simultaneous Incidents</td>
<td>.03 (.04)</td>
</tr>
<tr>
<td>Weekend</td>
<td>.12 (.01)**</td>
</tr>
<tr>
<td>Region</td>
<td>.09 (.09)</td>
</tr>
<tr>
<td>Period</td>
<td>-.12 (.01)**</td>
</tr>
<tr>
<td>Region × period</td>
<td>-.15 (.02)**</td>
</tr>
</tbody>
</table>

*Note: N = 1,722 (peripheral rail network) to 2,019 (core rail network) daily observations;*

* p < .05, ** p < .01.
FIGURE 2.2

Monthly Time Series for Multi-Organizational Performance (2007-2012) within Core and Peripheral Rail Networks
All in all, these results suggest that the shift from a more standardized and centralized organizational form towards an MTS approach in the core network was associated with a significant increase in multi-organizational performance. Moreover, the differential results for the core and peripheral networks suggest that it is unlikely that this performance improvement is due to general environmental changes rather than the MTS implementation.

**Qualitative Findings**

Although the present time-series analyses provide important insights into the performance implications of an MTS approach (relative to a more centralized and formalized structure) for multi-organizational collaboration, they cannot speak to the mechanisms and contingency factors underlying these implications. Hence, we used insights from our qualitative data to develop a more complete understanding in this regard. These analyses revealed that an MTS approach to multi-organizational collaboration can be beneficial because it enhances teams’ access to each other’s resources, information, and assistance during incident management. At the same time, however, our analyses pointed towards relevant risks and downsides associated with an MTS approach that have the potential to reduce multi-organizational performance. We discovered two important strategies (i.e., contingent coordination and developing cross-organizational understanding) that may help multi-organizational collaborations to realize the advantages and overcome the disadvantages of an MTS approach. Table 2.5 summarizes the results of the qualitative analyses.
## TABLE 2.5
Summary of Qualitative Findings

<table>
<thead>
<tr>
<th>Higher-order categories</th>
<th>Categories</th>
<th>Example excerpts from semi-structured interviews (translated from Dutch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advantages of an MTS approach</td>
<td>Accessibility of other teams</td>
<td>“Formerly, it took quite some time and multiple phone calls to figure out that we had to modify a countermeasure for an incident. Now, we sit right besides each other behind the same computer and detect such issues immediately.” (Rail Traffic Control, Member 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Requests had to pass multiple people before they arrived at the relevant person. Now we work much faster because we can contact carriers directly. We have shorter communication lines, which saves time.” (Back Office, Member 2)</td>
</tr>
<tr>
<td></td>
<td>Discussing options</td>
<td>“We help and advise each other. You can suggest to carriers that it would be better to cancel a particular train. Although it is their product, you can advise each other.” (Rail Traffic Control, member 1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“For example, yesterday all train traffic near Schiphol airport stalled because of an incident situation. I discussed with Back Office whether we could contact the police officers on site and ask if they could release part of the region. Back Office contacted the police with the result that they released the rail network earlier, enabling trains to continue with their planned routes sooner”. (National Rail Coordinator, Member 1)</td>
</tr>
<tr>
<td></td>
<td>Proactive planning</td>
<td>“There is a real interplay between teams in the OCCR. Formerly, we often reactively observed how an incident unfolded, but now it is much more proactive.” (Back Office, Member 2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“Collaboration has grown because everyone started to visit each other. We now prevent large delays in the aftermath of an incident because we better respond to each other.” (Central Service Desk, Member 1)</td>
</tr>
<tr>
<td>Disadvantages of an MTS approach</td>
<td>Differences in working methods and perspectives</td>
<td>“The Passenger Services team operates differently; while we try to plan for the future, the Passenger Services team is oriented towards the present. This sometimes causes a bit of friction.” (Rail Traffic Control, Member 2)</td>
</tr>
</tbody>
</table>
|                         |                                 | “Our interests align with those of ProRail’s Rail Traffic Control team. It’s just that you notice that Rail Traffic Control operates a bit different compared to us, which sometimes causes conflict or 

47
### Positioning problems

“I think that Prorail takes a too prominent role when you look at the OCCR; they tend to pull everything towards themselves.” (Nedtrain, Member 1)

Formerly, logistics was leading and we simply informed travellers of changes in train schedules. But logistics frequently created changes that caused confusion among travellers. We gained a voice in the logistical process and now work to prevent such issues.” (Traveller Information, Member 1)

### External interference

“You notice that the Allocation Center’s work pressure has significantly increased since we work within the OCCR. I doubt whether this is a good thing. You notice that people jump on a rail incident and try to make a mountain out of a molehill.” (Nedtrain, Member 1)

“We interfered with other teams’ actions without understanding them correctly. We had a different perspective and were repeatedly called to account for our interference.” (Passenger Services, Member 1)

### Contingent coordination

**Contingency-based use of liaisons**

“We have two layers: the liaisons level and member level. Communication is between liaisons; liaisons do not directly approach other teams’ members. Members of different teams can also communicate directly with each other. Liaisons, however, often set the stage. Liaisons meet to discuss the current state of the rail network and to determine what has to be done.” (Back Office, Member 2)

“As a liaison, I assess how busy the traffic controllers are; when they are very concentrated, you know that something is happening within the national rail network. I often ask for feedback to determine how things are going and traffic controllers inform me about what is going well and wrong. Then I summarize all clues on a piece of paper and gather the other liaisons to discuss how to deal with the situation.” (Rail Traffic Control, Member 2)

### Contingency-based mutual adjustments

“It depends on the type of incident. There are incidents in which you keep going back and forth to other teams, these are usually the situations that are more ambiguous and larger in impact.” (Allocation Center, Member 1)

“I interact with other teams throughout the incident situation, but the intensity of that interaction depends on the impact of the incident. A collision between a person and a train does not require much direct contact. This changes when there is a non-identifiable computer malfunction or some other sort of incident situation in which we do not really know what is going on. This is a tricky situation that requires a lot of direct contact.” (Rail Traffic Control, Member 1)
| Cross-Organizational Understanding | Common understanding of each other’s context | “No one seemed to understand how things worked around here. But now other teams see my actions, and when I refuse something it is much easier to show why I do so and to get other teams to understand this decision without continuously questioning it.” (Rail Traffic Control, Member 1)  
“Because you participate in the OCCR your perspectives of other teams’ preferences, possibilities, and constraints become much clearer. We can take this into account. That is an advantage of the OCCR.” (Central Service Desk, Member 1)  
“We used to receive a lot of complaints from other teams when we cancelled a delayed train. Formerly, we therefore allowed delayed trains to complete their route. But now we all realize that this is pointless. Although cancelling a train is inconvenient for passengers, it prevents an accumulation of delays for other passengers in the overall rail system.” (Allocation Center, Member 1)  
“Our experience is that other teams are more aware of the complete logistical chain behind it all.” (Asset Management, Member 1)  
“We had internship days, which allowed us to develop a general view of other teams’ organizations.” (Central Service Desk, Member 1)  
“We can now explain why we adjust something. We also went to other locations to explain matters.” (Traveller Information, Member 1) |
Advantages of an MTS approach to multi-organizational collaboration. Our interviewees highlighted several advantages associated with an MTS approach towards multi-organizational collaboration. Prior to the OCCR’s introduction, a standardized and centralized structure was used to manage rail incidents, aimed at reducing effortful, direct interaction and coordination between teams from different organizations. This structure, however, limited members’ opportunities to combine expert perspectives and information during incident management. Indeed, standardized protocols, distributed working locations, as well as indirect and centralized communication made information exchange a lengthy process. It sometimes took up to 28 separate phone calls, for example, to communicate critical information across organizational boundaries (Goodwin et al., 2012). In addition, a lack of clear common goals demotivated teams to work together. Informants stated that they had built “fences” around their organizations, ignoring their actions’ consequences for other teams and organizations operating within the rail network. Teams simply “threw problems over the fence” (Allocation Center, Member 1), such that problems were relocated rather than resolved. This delayed involved organizations’ joint assessment of a rail incident’s causes and consequences. Moreover, organizations were frequently ill informed about each other’s activities and experienced significant misalignments when they had to deviate from a plan or protocol:

“We just had to wait and see if things would proceed as planned. If a repair activity was supposed to be completed at 5 AM, it was possible that we were informed at 4:55 AM that completion was delayed by 3 hours. We were frequently unprepared and incident management occurred in a haphazard manner.”

(Rail Traffic Control, Member 2)

As anticipated by MTS theorists (e.g., Mathieu et al., 2001; Zaccaro et al., 2012), the new collocated and decentralized OCCR substantially facilitated communication within the multi-organizational collaboration. Members could now directly see and hear other organizations’ activities during incident management and directly approach external teams to discuss task-related issues. In addition, the MTS approach made teams from different
organizations more open to collaborating with each other by emphasizing organizations’ shared purpose of reducing disturbances within the rail network as a whole. As such, the MTS approach increased the ease, speed, and intensity of collaboration between different organizations’ teams (i.e., accessibility of other teams; see Table 2.5):

“We can easily approach each other and swiftly share relevant information in case something happens. Because of this, we can be very effective as a collective. This was difficult before because our messages had to go through ‘coffee filters’ before they reached other teams.” (Passenger Services, Member 1)

“The advantage of the OCCR is that we can intensively interact with each other—you see more of each other. We can easily discuss issues and we can work as a collective.” (Nedtrain, Member 1)

Improved access to other teams, in turn, helped members to better integrate each other’s inputs into collective actions. For example, members from different teams gained the opportunity to explicate their choices towards each other and to explain their options for resolving specific disturbances. Also, teams could actively probe external members’ inputs when facing difficult incident situations with multiple possible solutions (i.e., discussing options). This prevented misalignments and enabled teams to construct countermeasures that were broadly accepted and supported by all organizations within the OCCR:

“Infrastructure repair actions can disturb train traffic in the network. We always interact with rail traffic control and carriers and discuss how we can minimize such disturbances. We then collaboratively choose for one option. Sometimes the situation is so unsafe that we have no choice but to immediately [shutdown and] repair the infrastructure. But we always explain why it is so unsafe and why we have to fix it.” (Asset Management, Member 1)

“We check broken-down systems to assess their status and to determine if we can still use them. We explain the repair options to our partners and let them choose in 95% of all cases how to proceed.” (Central Service Desk, Member 1)

Better access to each other also helped teams’ proactive planning during incident management. Specifically, better access to other teams’ information and assistance enabled members to more accurately anticipate the scope (which parts of the core rail network are affected), scale (the size of a disturbance), and duration of an incident (how long will it take
until affected tracks can be used again). Teams could use such information to create reliable prognoses for the overall course of incident situations, outlining in detail when different teams would complete their respective parts of the collective endeavor. On this basis, teams were able to proactively prepare their own activities to better fit with other teams’ actions and schedules. For example, passenger carriers could start relocating trains and personnel earlier and restart train services sooner when a disturbed part of the rail network was released:

“We now anticipate on restarting scheduled train movements [after an incident], which was impossible before. Formerly, we just received a message saying that everything was clear and started planning from that moment. Now we really plan and communicate ahead and usually directly restart train services.” (Allocation Center, Member 1)

“We arrive at a definite prognosis one or one-and-a-half hours before the incident is resolved, which allows us to preplan our activities. We did not really have such definite prognoses before.” (Passenger Services, Member 1)

**Disadvantages of an MTS approach to multi-organizational collaboration.** These favorable aspects notwithstanding, interviewees also pointed towards various potential downsides of an MTS approach – corroborating theoretical arguments skeptical about the utility of this approach (e.g., Provan & Kenis, 2007). Collocation and lateral coordination demands within the MTS, for example, had blurred between-team boundaries. This was especially troublesome during the early phases of an incident’s management (i.e., directly following the detection of an incident). This phase typically is particularly hectic and messy, because different teams need to quickly adjust their organizations’ internal operations to the situation at hand (e.g., cancelling trains, sending repair crews, arranging alternative passenger transport). As such, team members need to concentrate on completing intra-organizational activities and instructing colleagues in the field. At the same time, members need to collaborate intensively with external teams to combine their unique information into an integral picture of the disturbance.
These parallel within-team and between-team activities caused some members to continuously shift between their own and other teams during early incident management phases, resulting in an unwieldy pattern of interactions within the collocated OCCR. A national rail coordinator described this process as a “plate of spaghetti,” with members suffering from substantial external interference: Members received many undirected and distracting requests for assistance and information from other teams, and responding to such requests placed large claims on members’ scarce resources and time. This aggravated members’ ability to realize their immediate team goals. As a result, OCCR members became reluctant to engage in between-team collaboration during early phases of incident management, focusing primarily on their within-team responsibilities instead:

“A lot of things happen in the first phase of an incident situation, and then you typically see members crawling into their own team. … I suspect that it is a sort of natural process. Members want to stay close to their own processes, because incident situations are urgent and challenging. There is something out of the ordinary that they have to deal with immediately.” (National Rail Coordinator, Member 1)

“In case of a large incident, everyone retreats to their own team.” (Nedtrain, Member 1)

To cope with this problem, some supervisors actively buffered their teams from external interference, completely obstructing other teams’ access to internal resources, information, and personnel. Other parts of the multi-organizational collaboration, however, received these intense gatekeeper activities (cf. Ancona & Caldwell, 1988) with substantial reservation. Members felt that such buffering undermined the OCCR’s key purpose and complicated interaction between teams. These conflicting orientations towards lateral coordination caused latent conflicts within the OCCR as a whole:

“The downside to the OCCR is that my team gets a lot of questions as soon as there is a broken-down train. Supervisors can’t always act as gatekeepers and that is annoying for my team. It was much easier to maintain a workspace free of interference before the OCCR existed, because you worked on your own island on your own problems.” (Nedtrain, Member 1)
“We received permission to directly approach anyone we liked in the OCCR, but other teams have a problem with that. They prefer that we go through their supervisor, so it happens that we are unwelcome in other teams. [...] But then there is no reason for being collocated, so we reject this attitude.” (Passenger Services, Member 1)

Collaboration within the new MTS was further complicated by teams’ former approaches to multi-organizational incident management. Members were accustomed to working independently towards reducing incidents’ consequences for their particular organization. This made it difficult to switch to lateral coordination mechanisms and consensual decision-making in the OCCR, because teams attempted to reinstate their prior independence by distancing themselves from the other teams in the OCCR. These teams feared that sharing information and knowledge might have detrimental financial outcomes and compromise their home organization’s competitive position. Other teams, in contrast, attempted to restore their independence by demanding a priority voice when deciding on how to resolve incidents, causing other teams to feel left out or marginalized. Hence, teams struggled to position themselves within this new collaborative multi-organizational context, which we refer to as positioning problems:

“One carrier thought, much more than others, that they had the sole right to use repaired rail infrastructure as soon as it became available” (Rail Traffic Control, Member 1)

“Sometimes I notice that other teams ignored the advice we provide them with. Every now and then I felt that our team was neglected within the OCCR.” (Nedtrain, Member 1)

“Only recently has Asset Management started to actively participate in the OCCR. At first they were very hesitant in providing information because they feared that there might be financial consequences attached to the sharing of information.” (Back Office, Member 2)

Finally, members from different teams initially had internalized distinct working methods that were optimized for their own organizations’ specialized working contexts and purposes. These routines were oftentimes very specific and hard to understand for outsiders, which became painfully apparent when teams became collocated within the OCCR and faced
increasing requirements for lateral coordination. The heightened salience of the differences in working methods and perspectives triggered frequent misunderstandings between teams, delaying collective incident management and representing a major source of frustration for the OCCR’s individual members:

“I was amazed to learn that it was particularly difficult to gather and combine relevant information in the OCCR. When you asked another team’s members for information, they typically misunderstood your request because they did not share your background” (Asset Management, Member 1)

“When cooperating with other teams in the OCCR, all teams need to attach the same definitions to the same terms. However, our team defined a stranded train very differently than other teams and that had to change within the OCCR.” (Nedtrain, Member 1)

Contingent coordination. Given the improvements in incident management performance illustrated in our quantitative data analyses, it appears that the OCCR was able to successfully utilize the potential advantages and overcome the potential disadvantages of the MTS approach. Our qualitative findings suggest that several processes were critical to achieve this. First, a contingent coordination approach emerged to deal with the external interference problems. This approach tailored lateral coordination to the specific phases and complexity of the incident management process by combining a contingency-based use of liaisons with a similarly contingency-based use of mutual adjustments between lower-level team members.

Specifically, teams within the OCCR collectively decided to use formal boundary spanners in the early phases of incident management (i.e., contingency-based use of liaisons), circumventing distractions from key intra-team responsibilities. The liaisons used as boundary spanners had supervisory roles within their respective teams, with formal authority to represent their teams’ interests and to decide upon their teams’ general courses of action. As such, they were particularly suitable for negotiating their teams’ initial strategic responses to incidents within the rail network. This flexible use of liaisons implied that, when a rail incident was first detected, liaisons from different teams would gather during ad-hoc meetings...
to exchange information and consider potential countermeasures, setting broad strategic
directions to guide their teams’ specialist members in later phases of the incident management
process. Subsequently, liaisons would actively monitor their teams for developments that
require system-level adjustments. When such situations occurred, liaisons would again initiate
ad-hoc meetings with each other to collectively coordinate the respective issues. In doing so,
liaisons reduced the need for specialist team members to discuss strategic directions through
effortful mutual adjustments (cf. Druskat & Wheeler, 2003). Hence, specialist members could
focus on within-team goals and operational activities without excessive external interference:

“In case of a large incident, we directly notify our liaison, who then initiates an ad-hoc meeting with
liaisons from other teams to assess the situation. This enables teams to directly explain their preference
and to decide on how to deal with the situation.” (Rail Traffic Control, Member 2)

“For detailed questions about disruptions we typically go directly to other teams’ members to find out
how the situation looks from their perspective. If something really needs investigating, we go to the
liaison and not to the members because researching such issues takes too much of members’ time.”
(Central Service Desk, Member 1)

At the same time, the contingent coordination approach preserved members’ direct
access to other teams when most needed (i.e., contingency-based mutual adjustment), thereby
allowing them to realize key benefits of an MTS approach. During later phases of the incident
management process, in particular, strategic coordination requirements are typically reduced,
with between-team coordination focusing on the adjustment of operational, task-related issues
within the overarching directions set during earlier phases. Such issues are often very detailed
and, consequently, cannot be easily resolved through liaisons’ mediating efforts. Moreover,
these operational issues are unlikely to alter the overall system’s direction and therefore do
not necessitate teams to collective renegotiate their overall courses of action. Indeed, most
operational issues within the OCCR involved further clarification of large and complex
incident situations or synchronization of detailed, task-level decisions when specialists work
towards resolving multiple incidents simultaneously. Contingent coordination, hence, allowed
specialist members from different teams to coordinate operational issues through direct mutual adjustments, while providing relief from strategic coordination requirements that typically exceed specialist members’ authority and competences:

“During a standard incident with a standard countermeasure we do not interact much because everything goes according to routines. This changes when it’s not a standard countermeasure, when there are multiple incidents, or when the incident occurred on a tricky place in the rail network. Then I have to discuss such issues with Rail Traffic Control.” (Passenger Services, Member 1)

“The intensity of coordination with other teams’ members increases as incidents get larger in scale and the state of the rail network gets more complex.” (Rail Traffic Control, Member 1)

**Cross-organizational understanding.** In order to effectively employ contingent coordination, members needed advanced insights into their partner organizations’ working contexts and tasks, as well as a thorough understanding of relevant between-team interdependencies. Within the OCCR, such insights gradually emerged through members’ development of cross-organizational understanding. Cross-organizational understanding refers to members’ knowledge of the diverse and interrelated nature of their multi-organizational working context. It provides different teams’ members with a “big picture” of the overall incident management process (i.e., a system-wide perspective) and a common understanding of each other’s context. Collectively, a system-wide perspective and a common understanding enabled members to understand the importance of other teams’ efforts for collective incident management and how their own team’s activities would affect others:

“Everyone knows what’s going on, maybe not in the finest detail, but definitely on a general level. We all have the same perspective.” (Rail Traffic Control, Member 2)

“You notice that members deal with incidents more professionally. They look at incidents with a broader scope.” (Allocation Center, Member 1)

In part, cross-organizational understanding developed naturally after the shift to an MTS approach, because collocated members became increasingly familiar with each other’s teams and working methods. Frequent face-to-face interactions within the OCCR allowed
members to directly observe other teams’ activities and get intimately acquainted with each other’s work processes (Beck & Plowman, 2014). Consequently, members from different teams had the opportunity to mutually explain their task execution, clarifying specific interdependencies and operational constraints:

“Our knowledge of other teams increased because we work right besides each other in the OCCR. You get to know people on a personal level, much more than would have been possible if we only telephoned each other; that is the human aspect of it. Second, there is a physical aspect, in that the OCCR facilitates members, if they are interested, to visit a partner team at a quiet moment and observe how things work in their organization.” (Rail Traffic Control, Member 1)

“The benefit of the OCCR is that it removes preconceptions; you can see what other teams do and how these teams’ members tackle problems. You get a lot of insights from other teams during ad-hoc meetings.” (Rail Traffic Control, Member 2)

In addition, the organizations within the OCCR arranged socialization activities to help individual members to make sense of their new, multi-organizational working context, thus further increasing cross-organizational understanding. These activities introduced members to each other and, in doing so, provided a platform for discussing different teams’ activities within the OCCR and determining relevant interrelations. As a result, members gained additional knowledge and appreciation of other teams’ roles in the OCCR. Example socialization activities included teams formally educating one another about their activities, internships in each other’s teams, and joint visits to different teams’ home organizations:

“Our understanding of other teams increased, among other thing, through joint activities, providing insights in each other’s teams, and through a lot of courses.” (Central Service Desk, Member 1)

“We invite people to visit each other’s teams and to see what the other does. That gives a good impression. You now know the importance of your own actions for this person when you do this or that.” (Rail Traffic Control, Member 2)

Despite these efforts, development of cross-organizational understanding within the OCCR required a prolonged learning process. As noted before, members held deep-seated and fundamentally different perspectives on incident management right after the start of the
OCCR, severely limiting their understanding of other teams’ activities. These differences initially complicated members’ cross-organizational understanding:

“It was a gradual process, with many conflicts, frustrations, and incorrect assumptions about other teams at first. Members initially expected things from the wrong partners and were referred to the wrong persons. Some individuals started out with simply no knowledge at all; they had no idea how everything worked.” (Rail Traffic Control, Member 1)

“When all teams came together in the OCCR everyone was of course very much oriented towards their own organization. We needed to figure out who did what; we needed to develop a collective way of doing things.” (Back Office, Member 2)

After a period of approximately one year, however, sufficient cross-organizational understanding had developed to significantly reduce the initial problems caused by the MTS approach. First, members’ awareness of distinct teams’ contributions to collective incident management largely diverted the dysfunctional positioning problems. Relatedly, insights into the complex, interrelated nature of incident management motivated members’ acceptance of common, system-level goals (rather than independent working routines and team-level interests). And finally, cross-organizational understanding enabled members to swiftly (and often implicitly) organize their own actions so as to support activities executed in other parts of the multi-organizational collaboration, and it allowed members to better sense when they could and could not request assistance and information from others. These insights and capacities streamlined collaboration and further minimized external interference:

“We need to work closely with the passenger carrier’s Allocation Center. At first we drove Allocation Center members practically mad, requesting assistance from them throughout the shift. But now we have learned to concentrate our requests at certain moments. Also, we now try to coordinate via a system of non-verbal communication.” (Nedtrain, Member 1)

“We now debate less with each other and are less inclined to push our own agenda. We now think of the interest of the overall process, the total train system, and nationwide rail corridors, that sort of things.” (Rail Traffic Control, Member 1)
Taken together, our qualitative analysis revealed that the shift from a centralized and formalized structure towards an MTS approach within the OCCR was beneficial for multi-organizational performance in rail incident management. This positive effect emerged through teams’ increased access to each other’s resources and assistance, providing them with additional opportunities for discussing options and proactively planning collective efforts. At the same time, our findings indicated that the MTS approach initially increased external interference, gave rise to power struggles and independent working routines, and emphasized teams’ differences in working methods and perspectives. Within the OCCR, these difficulties were mitigated by the emergence of a contingent coordination approach and members’ development of cross-organizational understanding, thus enabling the advantages of the MTS approach to prevail over its disadvantages. Figure 2.3 summarizes these results.
FIGURE 2.3

A Preliminary Model for Multi-Organizational Performance

**Advantages of MTS approach:**
- Accessibility other groups
- Discussing options
- Proactively planning

**Contingency factors:**
- Contingent coordination
- Cross-organizational understanding

**Disadvantages of MTS approach:**
- Difference in working methods
- Positioning problems
- External interference

Multi-organizational performance

Shift to an MTS approach
DISCUSSION

This study empirically investigated whether a decentralized and deformalized MTS approach to complex multi-organizational collaboration is more effective than alternative, more bureaucratic organizational forms (cf. DeChurch & Mathieu, 2009; Mathieu et al., 2001; Zaccaro et al., 2012). Although initial quantitative analyses supported the advantages of an MTS approach, qualitative follow-up analyses painted a more complicated picture. Results not only revealed that it took more than a year to fully realize the benefits of an MTS approach, but also that many of the disadvantages associated with this approach were highly salient right after its introduction. Although these problems were ultimately resolved through contingent coordination and the development of cross-organizational understanding, it therefore appears that realizing the potential strengths and mitigating the weaknesses of the MTS approach is more complex than much of the previous literature would suggest. Doing so requires careful implementation and flexibility in tailoring the new structure to its members’ specific needs and requirements.

Theoretical contributions

Our findings advance existing theory and knowledge in several different ways. First, prior research on multi-organizational collaboration in general and MTSs in particular has predominantly adopted rather static perspectives, highlighting conditions that may lead multi-organizational collaborations to adopt specific structural forms (e.g., Grandori & Soda, 1995; Gulati & Singh, 1998; for a review, see Provan & Kenis, 2007) or examining factors that may render a specific organizational form more or less effective (Klijn, Edelenbos, & Steijn, 2010; Silvia & McGuire, 2010). Our findings, in contrast, emphasize the importance of incorporating a temporal, longitudinal perspective for a full understanding of the consequences associated with distinct structural choices for multi-organizational collaborations. They reveal the intricate processes through which members adjust and adapt their working routines over time to fit with a
newly implemented MTS approach, thereby explicating how distinct benefits and shortcomings associated with this approach may unravel (Pettigrew, Woodman, & Cameron, 2001).

Second, our findings increase our understanding of the micro-level origins of interteam collaboration and coordination, highlighting how such collective activities may be organized as dynamic, cyclical processes. Consistent with prior research that has dynamically conceptualized interteam coordination (Marrone, 2004; Noble & Jones, 2006), we found that cooperation between teams from different organizations emerged in recurring cycles of “transition” and “action” phases (Marks et al., 2001: 360). During transition phases (i.e., the early phases of a rail incident), liaisons from different teams had a key role in negotiating a collective response strategy. They buffered their teams from external interferences in this phase and kept collective processes manageable. In subsequent action phases, however, teams collectively executed their specific parts of the respective strategy. Operational, task-related issues were coordinated through direct mutual adjustments between specialist team members during these phases, with little liaison involvement. This cyclical process allowed teams to focus on core task execution when needed, and to nevertheless profit from each other’s expertise and information. These findings address the pertinent problem of how multi-organizational collaborations can “create boundaries that are porous enough” to allow for resources and information to flow between teams from different organizations, but simultaneously “resistant enough” to preserve members’ time and energy for important team- and organizational-level activities (Faraj & Yan, 2009: 604; see also Ancona & Caldwell, 1988).

Third, the results of this study increase academic understanding of the role of collocation for multi-organizational performance. Previous research on multi-organizational alliances has suggested that collocation is important for enhancing teams’ access to each other’s resources and assistance (Beck & Plowman, 2014). Although our findings partly support this claim, they also
show that collocating teams can be a source of external interference and increase the salience of teams’ differences in working methods and perspectives. It took considerable time and support (e.g., through socialization activities) to enable team members to benefit from collocation, and positive effects only emerged when teams’ interests were linked by common, system-level goals. Interestingly, these observations are in line with research on intergroup contact (Allport, 1954; Pettigrew, 1998) and social identity theory (Ashforth & Mael, 1989), suggesting that face-to-face interaction, by itself, is not sufficient to overcome intergroup reservations. According to these theoretical perspectives, direct interpersonal contact is only beneficial under certain conditions, including the existence of common goals, support from authorities, and a cooperative setting with equal-status groups (Gaertner, Dovidio, & Bachman, 1996; Hewstone & Brown, 1986). Hence, our research suggests the potential usefulness of intergroup contact research and social identity theory as frameworks for increasing our understanding of how and when collocation of component teams can strengthen multi-organizational collaborations’ effectiveness.

Limitations

Although we believe this research has several strengths (e.g., the combination of longitudinal, quantitative time-series data with qualitative data including interviews and participant observations), some limitations need to be considered when interpreting the present results. First, our findings do not provide conclusive evidence about causality. Although the time series analyses compared results across an experimental and a control group (Cook & Campbell, 1979; Shadish et al., 2001), we recognize that our design was quasi-experimental and that corroborative evidence from truly randomized experimental studies is needed before full causal inference is warranted (Grant & Wall, 2009).

Second, it should be noted that our results are based on analyses of a single case. External validity of our findings may, thus, be restricted by the unique composition, activities, and history
of the multi-organizational collaboration we studied. It remains to be seen whether our findings are generalizable to other types of multi-organizational collaborations. It is possible, for example, that some multi-organizational collaborations may benefit from a more centralized and formalized structure (e.g., when collective tasks are less complex and interdependent; Provan & Kenis, 2007). Although our results align with previous theoretical considerations (Mathieu et al., 2001; Provan & Kenis, 2007), thereby increasing confidence in the relevance of our conclusions for other multi-organizational collaborations, it is important to corroborate these findings in alternative contexts (Goodwin et al., 2012; Marks & Luvison, 2012).

Finally, we identified mechanisms and moderating factors responsible for the effectiveness of the MTS approach at the OCCR using qualitative research methods. It is possible that interviewees’ responses were distorted by incomplete or selective recollection of past events. To minimize such biases, we selected informants that had gained extensive experience in both the pre- and post-OCCR period, thereby increasing the likelihood of accurate and detailed recollection of relevant incident management processes. Moreover, we validated interview responses with information from participant observations, official documents, and discussions with subject matter experts. Hence, we have confidence in our qualitative results’ reliability and completeness (Bowen, 2008). Nevertheless, it would be important to corroborate the mechanisms and boundary conditions we have identified and using different (e.g., quantitative) methods.

**Future Research Directions**

Our findings also suggest several interesting directions for future research. First, as noted before, scholars might study other real-life MTSs over an extended period of time to determine to what extent similar problems and remedies occur in alternative settings. Besides promoting generalizability, such research would contribute to a more complete and rich academic
understanding on how to manage the difficult and complex processes that cause the failure of many multi-organizational collaborations (cf. DeChurch & Mathieu, 2009).

Second, future research may investigate different sorts of collocation in multi-organizational collaborations. After an initial learning period and socialization activities, collocation of all OCCR members resulted in cross-organizational understanding in the present case that allowed members to overcome disadvantages and realize advantages of an MTS approach. Collocating all members from all teams is, however, not always possible and can create considerable costs. Further research could, therefore, examine how collocation strategies can be optimized within MTSs, such that associated benefits are preserved and costs reduced. Such research could, for example, investigate whether collocating only a selection of key boundary spanners (i.e., collocating only liaisons), or collocating members only temporally (rather than permanently) would suffice (cf. Beck & Plowman, 2014). Such research would provide valuable knowledge on the boundary conditions that may determine the feasibility and efficiency of collocation within an MTS approach.

Finally, it seems valuable to further investigate moderating conditions that may determine if an MTS approach can improve multi-organizational performance. Besides contingent coordination and cross-organizational understanding at the overall system level, for example, such research could consider individual member characteristics that might facilitate an MTS approach’s benefits for multi-organizational collaborations, such as members’ motivation to bridge differences between groups (Nagda, 2006), intergroup perspective taking (Todd, Bodenhausen, Richeson, & Galinsky, 2011), or interpersonal cognitive complexity (de Vries et al., 2014). Doing so would increase our knowledge about effective selection and training strategies for individual members within multi-organizational collaborations.
Practical Implications

This study has important practical implications for the design and management of multi-organizational collaborations. First, our findings suggest that administrators may increase the performance of multi-organizational collaborations by replacing traditional bureaucratic structures with more decentralized and deformalized alternatives based on the MTS approach. This new structural form may increase organizations’ access to each other’s resources and assistance, allowing them to better discuss, plan, and execute collective activities.

At the same time, our study reveals that realizing the advantages of an MTS approach requires contingent coordination, based on both a contingency-based use of liaisons, on the one hand, and direct mutual adjustments between specialist members, on the other. In particular, our findings point to the important role of liaisons who may reduce external interference caused by lateral and informal coordination between teams. Administrators using liaisons in their MTSs may provide them with specific leadership training for aligning their teams’ efforts with teams from other organizations (DeChurch & Marks, 2006; Druskat & Wheeler, 2003). It appears crucial, in this regard, that liaisons take an active role in setting strategic directions for both the overall MTS and their own teams, while withdrawing themselves from operational, task-level decisions and leaving such issues to specialist members’ mutual coordination.

Finally, our findings point to the importance of cross-organizational understanding for multi-organizational effectiveness, providing members with a system-wide overview of collective activities and, thus, promoting efficient and effective alignment between different teams. At the OCCR, members’ cross-organizational understanding was greatly enhanced through socialization activities. Administrators may use these findings to prepare for upcoming multi-organizational collaborations. Organizing socialization activities that allow individual members to develop an understanding of their future multi-organizational working context (e.g., through inter-
organizational transfer, movements, or rotations of key personnel) may prove highly beneficial in this regard, reducing members’ required adjustment times and facilitating smoother operations of an MTS-based multi-organizational collaboration from the outset.
APPENDIX

Semi-structured Interview Questions

Background information
What is your job within the OCCR?
What was your job before you joined the OCCR?
Which organization do you represent within the OCCR?
How long have you worked within the rail sector?
How long have you worked within the OCCR?

Job content
What are your main activities within the OCCR?
On which part of the rail network do you focus during your work in the OCCR?
Were these activities executed before the OCCR existed?
If yes, who executed these activities and in what way?

Responsibilities
What are your team’s core responsibilities within the OCCR?
What were your team’s core responsibilities before the OCCR existed?

Collective incident management
Are other teams involved in your activities within the OCCR?
If yes, which teams are involved in your activities and in what way?
Were these teams also involved in your activities before the OCCR existed?
What do you think about this change?
Did this change the duration of rail incidents? If yes, how is this noticeable?

How is your interaction with other teams sequenced within the OCCR?
When do you work with members from other teams in the OCCR?
How intensively do you work with members from other teams in the OCCR?
How was your interaction with other teams sequenced before the OCCR existed?
What do you think about this change?
Did this change the duration of rail incidents? If yes, how is this noticeable?

What kind of issues do you discuss with other teams in the OCCR?
What kind of issues did you discuss with other teams before the OCCR existed?
What do you think about this change?
Did this change the duration of rail incidents? If yes, how is this noticeable?

How is your contact with other teams organized in the OCCR?
How was your contact with other teams organized before the OCCR existed?
What do you think about this change?
Did this change the duration of rail incidents? If yes, how is this noticeable?

Which channels do you use to discuss issues with other teams in the OCCR (e.g., meetings, direct contact, technology)?
Which channels did you use to discuss issues with other teams before the OCCR existed?
What do you think about this change?
Did this change the duration of rail incidents? If yes, how is this noticeable?

How did coordination emerge between the different teams in the OCCR?
Were there any start-up problems?
If yes, how were they dealt with?

**Alternative developments**

Were there any other important developments since 2007 that may have affected the duration of rail incidents and/or improved multi-organizational incident management within the core rail network (e.g., new technologies, protocols, political pressure, etc.)?
Were there developments since 2007 (e.g., new technologies, protocols, political pressure, etc.) that may have affected the duration of rail incidents and/or improved multi-organizational incident management within the peripheral rail network?