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Multiteam systems in an agile environment: a realist systematic review

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Abstract
Purpose – The purpose of this paper is to highlight a collaborative effort between academia (University of North Texas, Team Sciences) and practice (Toyota Connected (TC)). This study concentrated on current problems that had been experienced by TC: How to structure and manage multiteam systems (MTSs)?
Design/methodology/approach – This research study utilized a realist systematic review to address an existing problem by working collaboratively with TC and academia. This collaboration involved problem identification, the development of research questions and a full systematic review guided by the research questions.
Findings – This realist systematic review merged the literature with current practices at TC in an effort to gather evidence to support the best method of structuring and managing MTSs. The findings include a leadership structure that incorporates both shared leadership (bottom-up) and existing hierarchical structures (top-down).
Practical implications – The MTS models presented in this study provide new models for organizations/manufacturers/industries to use as a guide when structuring their MTSs.
Originality/value – This study provides an example of a collaborative research effort between practice and academia using a realist systematic review. The paper also provides some multiteam system models that could be implemented and tested in different organizations. Also, new responsibilities and roles for scrum and MTSs are presented as a new method of achieving Agile.

Keywords Team performance, Team working, Teams, Agile manufacturing
Paper type Research paper

1. Introduction
Specific leadership functions are required for the success of multiteam systems (MTS). For example, leaders need to provide strategy and coordination within teams, across teams and with external stakeholders (DeChurch *et al.*, 2011). Other studies highlighted that leadership behavior needs to concentrate on the team's actions rather than team member behavior (DeChurch and Marks, 2006). Also, situations where leaders were able to

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synchronize team goals effectively and inter-team coordination increased overall MTS performance (DeChurch and Marks, 2006). Fortunately, research on MTSs is under investigation (DeChurch *et al.*, 2011) and growing. However, team composition for MTSs lacks exploration and analysis (Vessey and Landon, 2017; see also Bell *et al.*, 2015). Also, needed are efforts to understand leadership in MTSs: "we still know little about […] how leadership by different leaders in the system distinctively impacts team and MTS goal attainment" (Vessey and Landon 2017, p. 271). Researchers have called for additional research to be conducted around MTSs, to report what is known and to identify what is unknown, before moving forward (Shuffler *et al.*, 2015).

One critical component for successful MTSs is the attainment of not only each team's goal, but also the completion of the MTS's goal (Bienefeld and Grote, 2014). To attain a goal leadership, one must first identify it. Then, organize each team and MTS so that the diversity of skills and resources is collectively capable of achieving both the team's and MTS's goals. They must also coordinate activities and information during the process, serve coaching and facilitation roles (DeChurch and Marks, 2006) and provide communications within and between teams. With MTSs, teams have two sets of goals, proximal and distal. Proximal goals are related to the teams' goals and distal goals to the MTS's goal (Zaccaro *et al.*, 2012). Although individual teams have a variety of goals to aid them in achieving their objective, all teams within an MTS must have at least one common goal that connects them to the MTS's goal. This level of complexity is inherent in MTSs and not necessarily available in traditional team structures. New dynamics come into play when operating MTSs. Complexity occurs due to the architecture and an increased number of interactions and potential exchanges. Making a single leader's role even more difficult when having to manage dual functions such as "within-team and cross-team leader functions" (DeChurch and Marks, 2006, p. 312; see also Mathieu *et al.*, 2001).

Shared leadership has been shown to be most effective with teams when dealing with interdependence and when complexity of tasks is high (Bienefeld and Grote, 2014), and also when dealing with complex and dynamic problems as in innovation, R&D and project teams (Friedrich *et al.*, 2009). When a division of responsibilities occurs, as in top management teams (TMTs), shared leadership provides positive organizational outcomes, especially when behavioral integration (integration, collaboration and collective decision making) is utilized (Carmeli and Schaubroeck, 2006). In safety-critical domains, as in today's aviation environment, it is even more critical to combine "leadership requirements within and across teams […] making optimal use of shared leadership" (Bienefeld and Grote, 2014, p. 282).

When dealing with MTSs, one is not dealing with a traditional level of analysis (individual, team and organization). The dynamics and positionality of MTSs place it as a new level of analysis, the MTS level of analysis (DeChurch *et al.*, 2011). The MTS level of analysis has been identified as an "intermediate unit of analysis" (DeChurch *et al.*, 2011, p. 153), a "unique level of analysis within and across organizations" (Shuffler *et al.*, 2015, p. 661). Originally proposed as a new level of analysis by (Mathieu *et al.*, 2001; see also DeChurch and Marks, 2006; DeChurch *et al.*, 2011) but remains "virtually unstudied" (DeChurch and Marks, 2006, p. 326).

Other unknowns surrounding MTSs relate to their architecture. How is an MTS structured, organized and managed? In a recent review of MTSs, Shuffler *et al.* (2015) and Zaccaro *et al.* (2012) categorized MTSs into three attributes: compositional, linkage and developmental. Compositional attributes help uncover the demographic characteristics of MTSs, their structure, composition, team and network size, culture, and their traditional and virtual components (Shuffler *et al.*, 2015). Linkage attributes identify how teams and MTSs are linked to one another. Developmental attributes look at the changes, or maturity, that MTSs experience over time (Shuffler *et al.*, 2015; Zaccaro *et al.*, 2012).

With MTSs being a relatively new field of study and a new dynamic in the workplace, there remains much to be learned. The current research study attempted to uncover some of these questions. Primarily, this research study explored the following research questions:

RQ1. What types of MTS structures or configurations are successful?

RQ2. How is an MTS managed?

RQ3. What is the best leadership model for an MTS?

RQ4. How should the new MTS level of analysis be addressed in research?

RQ5. What are its current antecedents and outcomes?

Although no research study can answer all of these questions, this study attempted to shed light on some of these questions. The information uncovered in the current investigation provided enough information for future research in the field of MTSs. This research study also provided potential MTS working models that could aid future research on MTSs, also providing possible models for organizations currently trying to address these MTS problems.

2. Method

Systematic reviews provide a synthesis of the literature that is transparent and reproducible, providing evidence-informed knowledge that can inform policy and aid decision-making efforts within any institution/organization (Tranfield *et al.*, 2003). Compared to traditional literature reviews or integrated literature reviews (Torraco, 2005), systematic reviews offer a robust and transparent process that is both "rigorous in formulation and relevant to practice" (Torraco, 2016, p. 210). Systematic reviews can be conducted as a self-contained research project when exploring a specific problem derived from practice (Denyer and Tranfield, 2009) and in collaboration with the stakeholder throughout the process. In this case, systematic reviews have been identified as a research methodology (Denyer and Tranfield, 2009) beginning in the medical field and have since branched into other disciplines (see Ellwood *et al.*, 2017; Nguyen *et al.*, 2018; Nicaies *et al.*, 2013). The most significant advantage that systematic reviews, as a method, provide to the researcher is that they are capable of capturing specific mechanisms related to individual programs (Tranfield *et al.*, 2003). In the current research study, this "program" is identified as how MTSs are currently being structured and managed at the research location, Toyota Connected (TC). For the current research study, the researchers selected a systematic review as the chosen research methodology due to its rigor and level of synthesis.

Beyond general systematic reviews, the authors selected a realist review for synthesizing the literature. Realist reviews provide explanatory evidence as to "how complex programs work (or why they fail) in particular contexts and settings" (Pawson *et al.*, 2005, p. 21). For the current study, complex programs are represented by MTSs, and the context and setting are the customer's workplace and original team structural components (current configuration). In selecting a realist systematic review, the researchers were allowed to achieve the desired outcome as highlighted by Tranfield *et al.* (2003) "A realist synthesis can provide a transferable programme theory in the form of 'what works for whom in what circumstances' " (p. 218).

Realist systematic reviews are conducted in the following main steps; clarify scope, search for evidence, and appraise primary studies and extract data (Pawson *et al.*, 2005). These steps and how they were conducted for the current study are elaborated as follows.

2.1 Step 1: clarify scope

This section on clarifying the scope of the study was conducted through identification of four key elements. These elements are provided in Table I.

Step 1: clarify scope criteria	Researcher's response
a1. Identify the research question	1. How are multiteam systems structured? 2. What is the best intervention for organizing multiteam systems? 3. What is the best leadership model for multiteam systems?
a2. Nature and content of the intervention	1. Simple and complicated problems 2. Complex problems
a3. Circumstances or context for its use	1. What are the different interventions required for complicated and complex problems? Are there distinct differences? 2. The context is within the Toyota Connected (TC) system, utilizing teams trained in agile systems and operating agile teams in a real, open workplace, with proven successes
a4. Policy intentions or objectives	1. A new intervention for managing/organizing multiteam systems is desired and will be implemented and tested once a new intervention has been identified and agreed upon by the researchers and stakeholders
b1. Refine the purpose of the review	1. Evaluate program to identify problems and bottlenecks 2. Identify other comparable interventions that may work better 3. Identify all stakeholders involved
b2. Theory integrity – does the intervention work as predicted?	1. Test new intervention to identify if it works better than original
b3. Theory adjudication – which theories fit best?	1. Compare interventions, or continue modifying interventions, until a "best intervention" is identified
b4. Comparison – how does the intervention work in different settings, for different groups?	1. Test the new intervention using different samples and settings
b5. Reality testing – how does the policy intent of the intervention translate into practice?	1. Evaluate the testing of the new intervention
c1. Articulate key theories to be explored	1. Identify theory, or theories, that will be utilized to structure the chosen intervention(s) 2. Theories that address the multiteam level of analysis will be collected and mapped 3. Theories associated to the traditional, multilevel, or other levels of analysis (individual, team and organization) will be collected and mapped
c2. Draw up a "long list" of relevant program theories by exploratory searching (see Step 2)	1. Identification of a long list of theories that explain/describe each step in the intervention's process will be presented from the literature
c3. Group, categorize or synthesize theories	1. The theories presented in c2 will be categorized and synthesized based on their key characteristics and advantages/disadvantages and mapped according to the intervention stage that they represent
c4. Design a theoretically based evaluative framework to be "populated" with evidence	1. Design evaluation mechanisms to measure each of the identified theories 2. Design a testing strategy to measure the appropriate theory during each stage of the intervention. Know when to test and what to measure

Source: Key steps in realist review from Pawson *et al.* (2005)

Table I.
Realist systematic review criteria

Identifying the research question for the current study was an iterative process that required constant revisiting as new evidence was uncovered (Pawson *et al.*, 2005). The initial research question was posed at the beginning of the research study, the pre-review, and was agreed upon by the researchers and stakeholders

(Pawson *et al.*, 2005). Once agreed upon, an iterative process continued to assure that the research question was still relevant to the problem. The agreed upon items for Step 1, section a, are provided in Table I (see items a1, a2, a3, and a4).

2.1.1 Objective. To better identify the overall purpose of the research study, the items in section b (b1, b2, b3, b4, b5) were addressed (see Table I). The objective was to evaluate the existing intervention followed by identification of alternative interventions. Also, it was important to have an understanding of the theories involved to "articulate the body of working theories that lie behind the intervention" (Pawson *et al.*, 2005, p. 25). The theories identified from the literature were evaluated based on their relevance and ability to explain the intervention (see Section 6, Theories).

2.2 Step 2: search for evidence

The researchers utilized the Academic Search Complete business database to pull the initial set of journal articles. There were 34 journal articles selected using the following criteria: search term "multiteam system" in the title, scholarly (peer reviewed) journals, document type-article, published date from January 2008 to July 2018, and in English. This body of literature began the review of the literature for the current research study. Information pertaining to the research questions and theories related to any identified intervention (items identified in Table I) were coded. Also, as new theories and interventions were discovered (from original articles) during this initial coding process, new literature was searched, collected and then coded. This process continued until the researchers felt that theoretical saturation had been achieved. Theoretical saturation was identified by Pawson *et al.* (2005) asking "after each stage or cycle of searching whether the literature retrieved adds anything new to our understanding of the intervention and whether further searching is likely to add new knowledge" (p. 28).

2.3 Step 3: appraise primary studies and extract data

During the appraisal phase, researchers need to evaluate the data based on the characteristics of relevance and rigor. Relevance looked at whether the study addressed the tested theory and rigor determined whether a study's inference had merit and could be applicable to the intervention being studied (Pawson *et al.*, 2005). Primarily, this quality evaluation of the data determined if the information contained in each study met the purpose of the synthesis by identifying "the relevant contribution of each source" (Pawson *et al.*, 2005, p. 30).

Data collected from the studies were coded in an external database (Filemaker Pro 15). This allowed the researchers to identify categories and common themes as well as identify deficits in the literature. The data coded contained typical metadata along with relevant information about the intervention being studied. In this case, documents were reviewed for definitions of MTSs, different structures for MTSs, theories used to describe and test MTSs, along with specific details about what worked and what did not work when dealing with MTSs. The coding was categorized into six main sections: metadata, theories, compositional attributes, linkage attributes, developmental attributes, antecedents to multiteam level of analysis and outcomes of multiteam level of analysis.

Metadata coded the relevant information pertaining to each study (e.g. authors, journal, and year). Theories were collected as they related to the different attributes. Compositional attributes relate to information about the multiteam demographic characteristics (number of teams and average number of team members in a multiteam system), linkage attributes relate to mechanisms used to connect teams within the multiteam system, and developmental attributes related to information associated with how MTSs were shaped, formed, and evolved over time (Shuffler *et al.*, 2015). Data were also collected related to antecedents that have been identified as being associated with impact MTSs per each attribute.

For example, what factors or constructs had been found to impact compositional/linkage/developmental attributes in the literature? Similarly, outcomes from each attribute were also identified.

3. Teams, virtual teams and MTSs

3.1 Teams

Within the literature, there was a distinction between groups and teams; however, both terms were typically used interchangeably. First, both groups and teams were composed of two or more individuals who work on the same product. The main difference was that group members worked independent of one another, and team members worked interdependently with other team members (Taplin *et al.*, 2015). Teams were more dynamic due to this interdependent nature, requiring team members to perform tasks independently as well as interdependently, to interact with other team members, and to adapt, coordinate activities, share information and communicate with other team members throughout the process.

Teams essentially performed two basic functions, teamwork and taskwork. Teamwork was essential to the interdependent mechanisms that took place within teams and was often associated as emergent states: affective, behavior and cognitions (Dihn and Salas, 2017; Mathieu *et al.*, 2001; Taplin *et al.*, 2015). Taskwork was activities associated with the team's tasks that were required to accomplish the team's goal and were categorized as "task complexity, task interdependence and environmental uncertainty" (Gladstein, 1984, p. 501). Task interdependence was characterized into pooled, sequential, reciprocal and team interdependence (Taplin *et al.*, 2015). Pooled interdependence related to equal roles and expertise allowing members to function as a group rather than a team, sequential interdependence related to the sequential ordering of tasks in order for the team to complete its goal (Taplin *et al.*, 2015). Reciprocal interdependence was identified with tasks in which one team member's output could become another team member's input, and vice-versa, and team interdependence was where team members "mutually interact and collectively manage the flow of inputs and outputs between members" (Taplin *et al.*, 2015, p. 233). Task complexity related to the level of difficulty in the tasks, and environmental uncertainty was related to the level of complexity involved in the problem.

3.2 Virtual teams

As research on the phenomenon of virtual/distributed teams continues to grow, new definitions began to expand and refine the boundaries of this phenomenon. Initially, virtual teams were defined as "The distribution of team members across time and space, with communication enabled primarily via technological means" (Connaughton *et al.*, 2011, p. 504). More recently, however, virtual teams have expanded to include the team's "extent of virtualness" (Martins *et al.*, 2004, p. 807), treating a team's virtualness as a characteristic of the team as opposed to a team type. Martins *et al.* (2004) defined virtual teams as "teams whose members use technology to varying degrees in working across locational, temporal, and relational boundaries to accomplish an interdependent task" (p. 808). Given that most teams function today in less than the traditional face-to-face manner, most teams operate, to some extent, virtually (e.g. distributed, through technology). This placed teams within MTSs as a type of virtual team.

Virtual teams must be able to address three boundaries: locational, temporal and relational (Marks *et al.*, 2001; Martins *et al.*, 2004). Virtual teams need to work in different settings, environments, cultures and geographical locations. Similarly, MTSs involve multiple component teams within one MTS, with each component team working interdependently and sometimes across departmental and organizational boundaries. These locational boundaries applied to MTSs as much as they did for virtual teams. Temporal boundary was related to the lifecycle of a team and a team's ability to synchronize their efforts (Connaughton *et al.*, 2011). Just as with virtual teams, some component teams in an MTS were temporary or short-lived, whereas other component teams operated for the entire duration until the MTS's goal was achieved. Relational boundaries represented the different affiliations (e.g. other teams, departments and organizations) that a virtual, or component team, may have had at any one time (Connaughton *et al.*, 2011; Martins *et al.*, 2004). Within an MTS structure, component teams within the MTS made up each other's network (relational boundaries) as did the MTS itself, in addition to the organization(s). These networks identified the interactions external of each component team that required facilitation, each component team and the MTS were required to "navigate the different frames of reference, motivations, knowledge domains and work styles of those with whom they are interacting" (Connaughton *et al.*, 2011, p. 517).

3.3 Multiteam systems (MTSs)

One key characteristic of MTSs was that they operated with two or more component teams working toward a common MTS goal. These component teams also operated independently and had their own set of goals. These goals were characterized by Shuffler *et al.* (2015) and Zaccaro *et al.* (2012) as being proximal goals (component team goals) and distal goals (MTS goals). Each component team may have had the same, or different, proximal goals, depending on their skills, expertise and resources. Some component teams were formed for a short duration, while others had a tenure that lasted for the duration of the MTS. The structure of MTSs varied, as did the different component teams that made up an MTS. The leadership styles used within an MTS also varied, but the most prominent style was shared leadership (Goodwin *et al.*, 2012; Shuffler *et al.*, 2015) with some form of oversight or facilitation.

In general, MTSs were categorized into three types of attributes that represented their respective intra- and inter-team processes: compositional, linkage and developmental attributes (Shuffler *et al.*, 2015; Zaccaro *et al.*, 2012). Compositional attributes were associated with the demographic characteristics of MTSs (Shuffler *et al.*, 2015; Zaccaro *et al.*, 2012): number of component teams, team size, within organization or cross-organizational, function, geographic location and motive structure. Linkage attributes were related to the different mechanisms used to connect the component teams to one another, the component teams to the MTS (Shuffler *et al.*, 2015) and the MTS to the organization. Linkage attributes included coordination activities, hierarchical architecture, power distribution, communication structure, the level of networking and the different modes of communication required (Shuffler *et al.*, 2015; Zaccaro *et al.*, 2012). Last, developmental attributes were related to how the MTS evolved over time. Developmental attributes included the MTS's initial structure, the direction of development, tenure of the MTS, development at different stages and any other transformations that may have taken place (Shuffler *et al.*, 2015; Zaccaro *et al.*, 2012).

4. Types of MTSs

4.1 International joint ventures (IJVs)

Traditional joint ventures provide a level of complexity in that each team, or alliance, had a shared interest, ownership and control over the successful role out of the new product (Johnson *et al.*, 2002). When addressing IJVs, one added yet another level of complexity. Defined as a legal entity between more than one organization which reside in different countries (Johnson *et al.*, 2002).

Some problems experienced with IJVs included alignment of proximal goals with the IJVs distal goal. Other complications included differences in nationalities, culture and management styles to name only a few (Johnson *et al.*, 2002). Some studies have identified

IJVs as creating their own sub-culture, separate of the parent organization. This has led to differences in priorities and motivations toward project completion when comparing the parent organization and the sub-culture of the IJV. To account for these differences, IJVs have added a TMT to act as the linkage between the IJV and the parent organization (Johnson *et al.*, 2002). This TMT served as the linkage attribute in MTSs. Members of the TMT consisted of the senior executive in charge as well as the managers responsible for the day-to-day operations of the IJV (Johnson *et al.*, 2002).

4.2 Incident command systems (ICS) – government

An ICS had become the standard structure when responding to emergencies (Moynihan, 2007). An ICS operated as both a hierarchical and a network system, often termed as a hierarchical network organizational model, originally developed by firefighters as a way of dealing with the "organizational paradox that most crises create" (Moynihan, 2007, p. 6). A hierarchical network was defined by Moynihan (2007) as follows:

> A form of social coordination that uses hierarchical control, in the form of unified and centralized command, to help manage a network of organizations pursuing a shared goal. An ICS is neither a pure network nor a pure hierarchy, but it combines elements of both. The ICS model organizes incident responses around a central command. An incident commander sits atop the hierarchy, overseeing a variety of functional units-usually planning, operations, logistics, and administration/finance. (p. 6)

Dealing with complexity in the workplace has been very similar to dealing with emergency situations in that many unknowns were present at the onset. Many different units or teams were implemented for managing the crises. Similarly, MTSs dealt with complexity and assigned teams to address different aspects of the complex problem. The ICS at times acted as the MTS, while the incident commander could be the linkage that operated between the MTS and the component teams. Modifying Moynihan's (2007) list of answers to hierarchical networks, the following items have been changed given the context of MTSs. The modifications included changing ICS with MTS, networks with component teams and crises with complexity or problems:

(1) the MTS model incorporated elements of both hierarchy and component teams;

(2) rapidly changing complexity limited the efficacy of a centralized command;

(3) component teams grew as complexity grew, incorporating new members and becoming more difficult to coordinate;

(4) conflict about who was in charge was likely for large or complex problems, undermining component team coordination;

(5) the potential consequences and time constraints of complex problems made it critical that MTSs have high capacity; and

(6) even with command and control systems, MTSs depended on component team values such as trust and norms of reciprocity to succeed (Moynihan, 2007, p. 7).

Successful ICS was dependent upon having a clear and functional central command (Moynihan, 2007). This translated to a successful MTS such that an MTS must have had a clear and functional linkage system. This linkage could have been either a single individual or could have consisted of a team, dependent upon the size of the overall project and the number of component teams and geographical dispersion between component teams. Recommendations for managing ICSs include the following (Moynihan, 2007), these recommendations have been modified to be MTS specific. First, coordinate among component teams and individual members. Second, communicate a shared challenge and purpose to all component teams and members. Third, highlight contributions made by component teams to other component teams. Fourth, align the linkage of the expectations of the MTS with those of the component teams.

4.3 Organizational models

Marks and Luvison (2012) presented two MTS models for private sector organizations. These models presented structures for dealing with product launch for a high-tech company and for a pharmaceutical firm. In both cases, the MTS's structure changed depending upon which product development phase the organization was in. For example, the high-tech MTS was separated into three structures, one for the development phase, one for the launch coordination phase and a separate structure for the ongoing sales phase. During the development phase, three departments were involved along with their component teams: hardware, software and production. In the launch coordination phase, all departments were involved with their respective component teams: hardware, software, production, marketing, sales and support. During the ongoing sales phase, only three departments and their related component teams were involved: production, sales and support. This structure resulted in six functional departments or units, each with their own number of component teams. Component teams within each department had influence over other component teams within the same department. However, they had little to no influence over component teams in other departments. Although component teams had little influence over other component teams in different departments, each component team was able to influence the activities in the MTS. Oversight for each phase was conducted by a project manager who would coordinate activities for the MTS. This project manager had low positional power in that they had little or no control over the component teams (Marks and Luvison, 2012). This MTS was best described by Marks and Luvison (2012) as "A fairly decentralized communication network in that interteam communication occurs directly among team members rather than through centralized boundary spanners" (p. 42).

The second example for the pharmaceutical MTS involved two organizations in one alliance. This MTS was divided into three component teams: executive management, alliance management and support (Marks and Luvison, 2012). Similarly, as in the previous example, the MTS changes depended on which phase it was operating in. For example, during the pre-agreement phase, the executive management component teams for both organizations were operating. In the handoff phase, the executive management and alliance management component teams were operating. For the last phase, the post-agreement phase, the alliance management component teams were the only teams utilized. The number of teams within each component team varied depending on the phase. These systems operated as mirroring functions, meaning that the same component teams operating in one organization were operating in the second organization for each phase. Generally, the executive management component teams had control over the MTS. However, the power structure weakened given that this control was shared among two geographically dispersed organizations. This allowed each component team to operate more independently, serving their own proximal goals further removed from the distal goal of the MTS.

4.4 Operational control center rail (OCCR)

As a key mode of transportation in the Netherlands, rail transportation is a public safety concern with a majority of the population relying on the reliability of the rail system. Recent problems addressing failures that had led to excessive delays warranted a new type of structure, the OCCR (Goodwin *et al.*, 2012). Findings indicated that the current system "failed to match the increased complexity and dynamics of the (current rail) network" (Goodwin *et al.*, 2012, p. 56). The OCCR was developed as an MTS with multiple representative organizations, identified here as component teams. Each of the component teams had a director that communicated with the other component team directors (Goodwin *et al.*, 2012). These directors operated as an oversight team and a single person was assigned to oversee the operations of the team of directors, this person was called the national coordinator rail (NCR; Goodwin *et al.*, 2012). Leadership took the form of a shared leadership model in which "the directors influence each other in order to find solutions to the shared problem" (Goodwin *et al.*, 2012, p. 59). The role of the NCR was only to facilitate the team of directors meetings with the mandate to "enforce an end decision if the directors do not arrive at a timely decision" (Goodwin *et al.*, 2012, p. 59). The OCCR attended to its goals by applying collaboration among the directors with action plans driven from the directors to the component team members. Interactions between component teams were facilitated by the NCR.

5. Leadership

5.1 Boundary spanners

In leading military units, leaders have been needed to monitor, keep up with activities, interact within and between teams, and be adaptive and responsive to all stakeholders (Connaughton *et al.*, 2011). Some military departments have utilized boundary spanners as leaders. Boundary spanners were defined as "organizational members whose primary role is to communicate extensively with constituencies in a relevant environment" (Connaughton *et al.*, 2011, p. 516). Some of the functions performed by boundary spanners included translating specialized knowledge and coordinating activities both within and between teams (Connaughton *et al.*, 2011).

As a mid-level leadership style, boundary spanners showed promise as one potential style for MTSs (Connaughton *et al.* 2011). Communicating specialized knowledge and coordinating activities within and between teams became critical for MTSs. Each component team within an MTS had its own proximal goals with at least one distal goal shared with the MTS's goal. Coordinating these activities among each component team to assure that they accomplished their proximal goals, as well as reassuring that every team's output collectively contributed to the overall MTS's goal, became a complex task that could only be performed outside the component team structure.

5.2 Shared leadership

In existing MTS models, the leadership function followed a shared leadership model rather than a traditional leader–follower paradigm. In the case of the MTS that oversaw the rail system in the Netherlands, shared leadership in conjunction with a facilitator was deemed the best form of leadership (Goodwin *et al.*, 2012): "The leadership role in the [MTS] […] does not easily fit a leader-follower paradigm where decision authority stays with the leader. It is assumed that a shared leadership model plus a facilitating, impartial leader (coordinator) will be more effective" (p. 64). In this model, the component team leaders, the directors, operated on a shared leadership model, team of directors, with oversight given to an independent coordinator who was not involved in the activities of the component teams. The coordinator oversaw and facilitated the team of director's actions, coordinated activities for the MTS's goals (distal goals) and acted as a decision maker when a team of directors was unable to make decisions (Goodwin *et al.*, 2012). Shared leadership is defined as:

> A dynamic, interactive influence process among individuals in groups for which the objective is to lead one another to the achievement of group or organizational goals or both. This influence process often involves peer, or lateral, influence and at other times involves upward or downward hierarchical influence. (Pearce *et al.*, 2007, p. 282; see also Bienefeld and Grote, 2014)

In discussing what task characteristics call for shared leadership, Pearce (2004) highlighted tasks that were highly interdependent, which required a high level of creativity, and tasks that involved high levels of complexity, placing shared leadership idea for team-based systems. Shared leadership should be considered whenever the three characteristics of interdependence, creativity and complexity are in play (Pearce, 2004). Even with shared leadership, there is still a need of some level of traditional leadership to support the team's efforts. Here, shared leadership was best supported through traditional leadership styles: "directive, transactional, transformational and empowering" (Pearce, 2004, p. 53). Support for the team came from a leader who clarified the organization's goal and the team's role in achieving this goal (Pearce, 2004). This support needed to be in such a manner that the team members did not feel they were being managed, leadership must not have exerted power or influence over individual team members. In the words of Pearce (2004), "shared leadership support should be inherently cautious" (p. 54).

Shared leadership also looked at the shared aspect of leadership, identifying all leadership as being shared, at one time or another (Pearce *et al.*, 2014). Shared leadership involved: "the serial emergence of both official and unofficial leaders as part of a simultaneous, ongoing, mutual influence process" (Pearce *et al.*, 2014, p. 276). From the perspective of shared leadership, leadership involved multiple players at every level. The amount and method in which this shared-ness took place varied. The role of being-the-leader not only could have been based on power-distance, knowledge, or experience, but also could have been designed around a coaching/mentoring structure. This placed trust as a critical aspect to successful shared leadership (Pearce *et al.*, 2014). Building a transactive memory systems is also critical, providing team members with information relating to, who knew what, and who had what knowledge and experience (Pearce *et al.*, 2014).

Other research highlighted some form of shared leadership for MTSs (Shuffler *et al.*, 2015) in conjunction with some type of oversight. Either from an individual leader or by a leadership team perspective, shared leadership and traditional vertical leadership models should "work in tandem" (Pearce *et al.*, 2014, p. 285). The specific leadership style did vary depending on the size and structure of the MTS. Leadership was also different for MTSs that were housed within one corporation or entity. Generally, researchers have found that "sharing of leadership among team members can complement the formal leadership structure" (Shuffler *et al.*, 2015, p. 679). Exactly what this leadership model looked like was different for each MTS.

6. Theories

A number of theories emerged from the systematic review. Each of these theories that follow served as a foundation to explain the observations and outcomes of MTSs examined in the literature.

6.1 Naturalistic decision making (NDM)

NDM theory involves the understanding of how decisions are made in the real world (Alison *et al.*, 2015). While there is no formal NDM theory, there are a number of assumptions that could lead to an overarching theory. Here, NDM relates to the following assumptions:

(1) cognitive processing in the real-world varies;

(2) situation assessment is critical;

(3) mental imagery is important;

(4) the decision-making context must be specified;

(5) decision making is dynamic; and

(6) research should focus on how decision makers actually function rather than how they ought to function (Alison *et al.*, 2015, p. 296).

6.2 Expected utility theory

From economics, expected utility theory identifies how decisions are selected when the outcomes from these decisions are unknown (see http://policonomics.com/expected-utility-theory). Expected utility theory states that decision makers have risky prospects to choose from when making a decision and often choose the option that provides the highest expected utility (Alison *et al.*, 2015).

6.3 Cognitive constraints

One's own rationality is limited based on one's cognitive constraints (Alison *et al.*, 2015). This states that the decision maker is limited by the limitations of the decision maker. These limitations include the cognitive, motivational and perceptual processes (Leibiere and Anderson, 2011).

6.4 Exchange theory

Exchange theory can be explained as one's commitment due to "an exchange of effort and loyalty for economic benefits and social rewards" (Johnson *et al.*, 2002, p. 1143). One example is in an employee's commitment to the organization they work for. In relation to MTSs, exchange theory has been used to identify the commitment employed by linkages. For example, the parent company provides the inducements and motivation, while the IJV are committed to the parent company's goals and values (Johnson *et al.*, 2002). The linkage, TMTs, can be committed to both the parent company and the IJV.

6.5 Social identity theory

Social identity theory relates to how individuals "identify with and form bonds to various groups and organizations" (Johnson *et al.*, 2002, p. 1144). How one identifies with a particular team is dependent on how one perceives, interprets and responds to the behavior of the team and its members (Reimer *et al.*, 2017). When people associate themselves with a team, they tend to accentuate similarities with other team members and highlight differences with members from other groups (Reimer *et al.*, 2017). Also, members who identify with a particular team "favor tasks, roles and responsibilities associated with the in-group over […] the out–group to achieve and reinforce a positive social identity" (Reimer *et al.*, 2017, p. e1022). Within the context of MTSs, having team members' self-identity with their component team as well as the MTS, without being too competitive against the other component teams within the same MTS, is the challenge. This competition has been identified as hypercompetition and "occurs when intrateam members favor in-group goals over collective interterm goals and so will prioritize the goals of their own team" (Power and Alison, 2017, p. 55). This leads to a new MTS-social identity theory: individuals associate themselves with teams in which they form natural bonds with individual team members who make up the team. Also, individuals have a feeling of commitment to the higher level team, the MTS. Any disassociation between the team's tasks, roles, responsibilities, beliefs and values with those of the MTS causes separation between the team members and the MTS, forcing the team members to primarily support the team's goals as opposed to the MTS's goals.

6.6 Organizational identification

Based on social identity theory, organizational identification is associated with how one's attributes align with the same attributes of the organization (Johnson *et al.*, 2002).

6.7 Procedural justice theory

Procedural justice theory reviews "how decision-making procedures affect those who have a stake in, but limited control over, the outcome of the decision" (Johnson *et al.*, 2002, p. 1145). In relation to component teams within an MTS, it is believed that procedural justice could enhance commitment toward the MTS more so than that toward the parent company.

7. MTSs at TC

In the Methodology section, in Table I, the scope of the current study was to identify: How are MTSs structured? What is the best intervention for organizing MTSs? What is the best leadership model for MTSs? The information presented previously in this systematic review identified how different MTSs were structured as well as introduced different leadership models (items 1 and 3) for MTSs from the literature. This section further identifies how the research location, TC, structured scrum, a framework for agility, using their iteration of an MTS, a Teams of scrums or scrum of scrums. The second item in this study's scope, identifying the best method of organizing a multiteam system for the research location (TC) will be covered in the next section titled Proposed solutions for MTS structures at TC.

Although an agile approach is followed, essentially as prescribed and better than most organizations, the processes at TC can still be improved upon. This continuous improvement culture is embedded within the originating threads of the organization, today known as the Toyota Way. In describing the Toyota Way, Liker (2004) highlighted the four key principles of the Toyota Way:

(1) problem solving (continuous improvement and learning);

(2) people and partners (respect, challenge and grow them);

(3) process (eliminate waste); and

(4) philosophy (long-term thinking).

Scrum is a framework that helps the organization achieve agility. Within the continuous improvement culture, different organizations develop different structures in their quest to agility. This point is highlighted by Rubin (2013): "organizations should always stay true to the scrum framework while choosing an appropriate blend of approaches for their Scrum implementations" (p. xxxv). The current paper is just one effort aimed at supporting TC's goal of improving the Scrum in their quest to achieving agility.

This section highlights the current scrum framework utilized by TC today and introduces the common Agile language and terms. These terms will be compared with the common terms previously discussed in the MTS literature and comparisons will be made. The scrum framework terminology will remain in future models presented in this study, as best as possible, as this is the language familiar with the research location stakeholders.

7.1 Scrum, a framework for agility

In Agile, the scrum framework is one method of achieving Agile. Scrum leads to new innovations and new product development; it is a team-based framework for "organizing and managing work" (Rubin, 2013, p. 13). At TC, this organizing and managing is conducted through empirical planning processes. Scrum is basically a cross-functional team designed to achieve a set of objectives or tasks, called product backlog items (PBI). Scrum prioritizes its own PBI and self-assigns that PBI will be worked on and when. Scrums are self-organizing and only take on tasks from the PBI that can be completed during the iteration cycle; this iteration cycle is called a sprint. Each sprint at TC is either one or two weeks in length. Team members synchronize frequently before each sprint in a sprint planning session and meet daily during a sprint at daily scrum events (Rubin, 2013). After each sprint, teams discuss the end product with the customer and key stakeholders during a sprint review. They also hold sprint retrospective events (Rubin, 2013) that cover the processes taken and any problems encountered along the way. When the PBI is revisited, decisions are made as to which items to accept for the next sprint. This revisiting and reprioritization of PBI is known as backlog refinement. Backlog refinement allows the team to be adaptable and able to change direction when needed.

A scrum team is made up of three roles: product owner (PO), scrum master (SM) and the development team (DT) (Rubin, 2013; Schwaber and Sutherland, 2017). Within the scrum team, the PO's primary responsibility is managing the priority of the DT's backlog. Here, the PO's role includes:

- clearly expressing PBI;
- ordering the items in the product backlog to best achieve goals and missions;
- optimizing the value of the work the DT performs;
- ensuring that the product backlog is visible, transparent and clear to all, and shows what the scrum team will work on next; and
- ensuring the DT understands items in the product backlog to the level needed (Schwaber and Sutherland, 2017, p. 6).

The DT is responsible for achieving the team's objective at the end of each sprint. The DT members pull from the PBI items that they feel can be accomplished during the next sprint based on empirical data and the team's capacity (measure of performance). The characteristics of a DT include the following points:

- They are self-organizing. No one (not even the SM) tells the DT how to turn product backlog into increments of potentially releasable (and/or valuable at TC) functionality.
- DTs are cross functional, with all the skills as a team necessary to create a product increment.
- Scrum recognizes no titles for DT members, regardless of the work being performed by the person.
- Scrum recognizes no sub-teams in the DT, regardless of domains that need to be addressed like testing, architecture, operations or business analysis.
- Individual DT members may have specialized skills and areas of focus, but accountability belongs to the DT as a whole (Schwaber and Sutherland, 2017, p. 7).

The SM serves as a coach/mentor to the DT members while also fostering interactions between DT members and external team members when needed (Schwaber and Sutherland, 2017). SMs are also responsible for assuring that the DT members understand the team's goals and each item in the product backlog. Also, they aid the PO in assigning priorities to the PBI (Schwaber and Sutherland, 2017).

7.2 Multiple scrum teams

When dealing with single products a cross-functional team can be effective. However, in most cases, multiple scrum teams are required when taking on large product developments. Having multiple scrum teams is known as a scrum of scrums (Rubin, 2013). TC extends the meaning of scrum of scrums as teams working interdependently with a common goal. A general model of this meta-scrum structure is provided in Figure 1. Each scrum team consists of a PO, an SM, and a DT. At TC, the overall vision for a product is directed downward from a chief product owner (CPO) to each PO. Then, it is

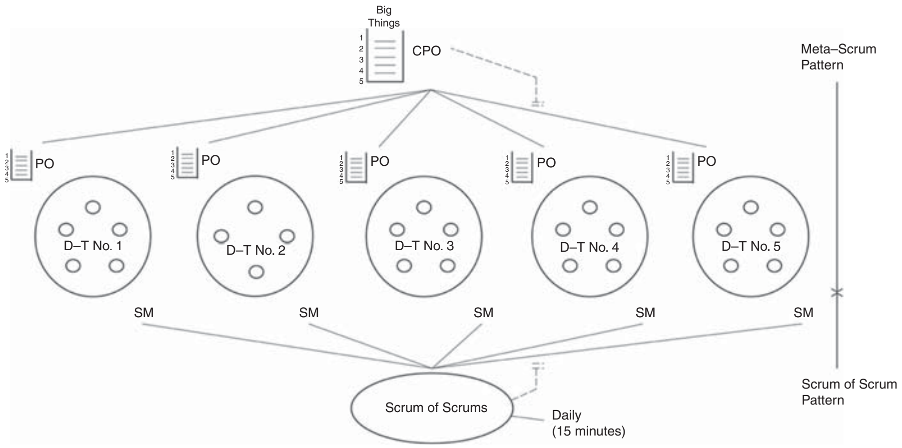

Figure 1.
Meta-Scrum at TC

Notes: A backlog is represented by the list of items with numbers 1 through 5. CPO, chief product owner; D–T No., development team followed by the team's number; PO, product owner; SM, scrum master

directed downward to the team members. This overall vision is depicted by the list next to the CPO in Figure 1 titled Big Things. At TC, the scrum framework is augmented by two patterns, with the first being the meta-scrum pattern and the second being the scrum-of-scrum pattern. The CPO oversees the meta-scrum pattern, while the SM (or pertinent team member) oversees the scrum-of-scrum pattern. The CPO is responsible for the entirety of the product development (see dashed line in Figure 1) and is the front line of contact for the organization and the stakeholders. For the scrum of scrums, each SM (or any key team member critical to the current activity) meets daily for 15 min to discuss and coordinate activities at the product delivery level.

The product backlog consists of PBIs as defined in the scrum guide (Schwaber and Sutherland, 2017). Each PBI is refined so that it can be completed in no more than one sprint. This means that a single PBI becomes several PBIs as it is progressively refined to make it deliverable in a sprint. Team members select items from the product backlog for each sprint and create a sprint backlog. The sprint backlog contains the work to achieve the proximal goal of the sprint. The combined work of the multiple teams forms the distal goal. Once the work in a sprint has been identified as Done, team members select items from the updated product backlog to work on during the next sprint. After each sprint, the items in the product backlog have been updated and re-prioritized for the team members. This iterative cycle continues until the product is considered complete, or until a team has completed their portion of the product.

There are numerous methods of structuring multiple scrum teams, also known as meta-scrum teams at TC and in Agile language. The methods identified above represent the general structure that is utilized currently by TC today.

8. Proposed solutions for MTS structures at TC

Within TC, there are two main areas that need to be addressed, the leadership structure of MTSs and the structure of an MTS when it spans across two or more organizations. These problem areas are common to most organizations operating multiple teams (e.g. Agile, ICS, IJV) and are not specific only to TC. This section addresses the final research question:

RQ6. What is the best intervention for organizing MTSs?

Here, the best potential model for managing MTSs for TC and structuring an MTS model that spans multiple organizations was presented. This next section presents new potential models based on synthesizing the MTS literature and the experiences gained by TC.

8.1 Managing MTSs for TC

An overview of the different leadership structures, hierarchical roles and responsibilities for MTSs is provided in Figure 2. The horizontal line represents the division between the shared leadership model (below line) and the organization's existing hierarchical structure (above line). This figure presents a combined hierarchical and network system as highlighted by Moynihan (2007) or a shared leadership model with a facilitator as presented by Goodwin *et al.* (2012). This horizontal line also differentiates the proximal goals from the distal goal.

The facilitator acts as a top-down authority who relays organizational goals (distal goals) to the team of POs. This facilitator presents the organizations' identity downward to the DT, while the POs balance the development of team identity (social identity theory; see Johnson *et al.*, 2002) with the organizations' identity (organizational identity; see Johnson *et al.*, 2002). The team of POs, along with the facilitator, implements procedural justice (Johnson *et al.*, 2002) by monitoring of the DT's decisions to assure that the MTS's interests are being met. The remaining structure from the DT to the POs who make up the team of POs is a bottom-up process. Here, individual team members decide their proximal goals as a means of achieving the overall distal goal. This places the decision-making capabilities in the hands of those closest to the work. In keeping with the NDM theory (Alison *et al.*, 2015), situation assessment is critical in developing mental images relating to real-world problems. The proximal goals, strategy and coordination of activities are set by the team members as they are closest to the problem. This is opposite to the scrum method where the PO pushes the list of backlog items downward to the team. This activity, having team members develop their own proximal goals and strategy, also allows team members to self-identify with their team, providing members with a sense of belonging toward the team (social identity theory; see Johnson *et al.*, 2002). The SM is better positioned to manage the team's taskwork activities as the it is involved with the inner workings of the team while also being a member of the team. The PO is better able to monitor and facilitate, as a team coach, teamwork capabilities. Team coaching concentrates on "working processes, team organization, distribution of roles and responsibilities and optimization of communication" (Korner *et al.*, 2017, p. 4). This requires the PO to step away from the role as a team member

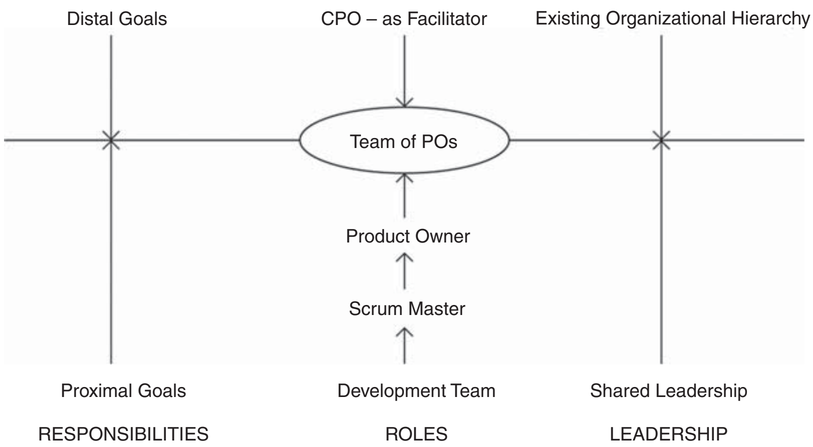

Figure 2.
Hierarchical roles, leadership and responsibilities for new MTS

to assess and optimize teamwork. The team coach also communicates the distal goals within and between each DT while also coordinating activities. This provides each team and their members with a sense of belonging to a larger team, the MTS, in addition to belonging to their own DT (social identity theory, organizational identification; see Johnson *et al.*, 2002).

One criticism of the scrum framework is that it is too task dependent, often missing in the facilitation and management of teamwork. The MTS models presented in the current study combine knowledge from the literature with current practice. These models include scalable MTSs that could be tested and further developed. This scaling effort is not an exercise in aggregation: "the unsafe practices of scaling by aggregation and creating highly structured engineering diagrams for what should be organic processes" (Snowden, 2018, paragraph 1). Rather, these models represent scaling that has built-in components allowing for the organic functions of teamwork, team coaching, shared leadership and facilitation to take root. These scaling models address some of the deficits of scrum that have been identified: "What is fed into a sprint, at what level of granularity and with what pre-processes is not always addressed" (Snowden, 2012, paragraph 8). This level of granularity is provided in the MTS models presented in the current study.

Figure 3 expands the view of leadership, responsibilities and roles from Figure 2 to a model that includes a simple MTS. This figure provides a structure of interdependence among the DTs while also maintaining a structure that maintains the overall goal of the MTS (organizational identity; see Johnson *et al.*, 2002). Scaling this MTS model to the next level, Figure 4 presents a potential model that could be used for meta-MTSs. There are three MTSs operating under one meta-MTS. Depending on the context, these MTSs could be internal to one company, or they could be three different companies working in an alliance.

Some of the challenges faced by MTSs include alignment of goals, lack of communication, rivalries among teams, lack cooperation and cohesion, lack of discussion around roles and milestones, lack of coordination of individual tasks, and a lack of coordination across teams (Gerber *et al.*, 2016). To address issues such as poor alignment of goals and poor communications, Gerber *et al.* (2016) recommended that teams create opportunities for members to discuss mutual goals and to share information. Addressing problems with poor communication and lack of discussions, Gerber *et al.* (2016) recommended having team members develop their team's deliverables, forming a shared understanding of the goals and processes required to obtain each goal. Also, these behaviors improve team member identity (social identity theory; see Johnson *et al.*, 2002). Through shared leadership, team members decide their team's goals, which tasks are required to achieve these goals and what resources

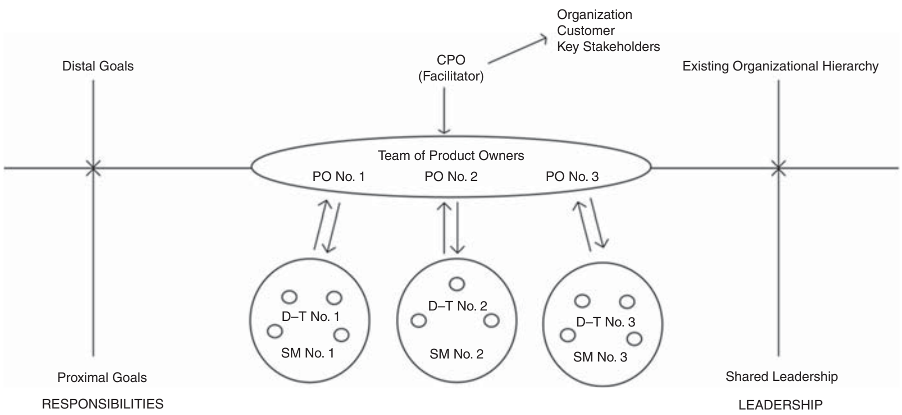

Figure 3.
New MTS with team of POs and CPO as facilitator

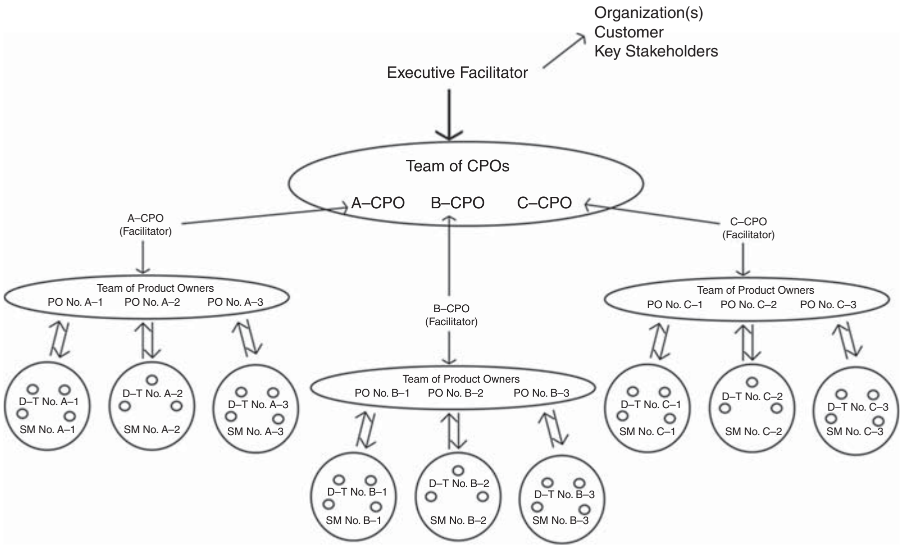

Figure 4.
Meta-MTS

will be necessary (expected utility theory; see Alison *et al.*, 2015). Interactions among team members further support developing a shared understanding and foster team cognition (e.g. transactive memory systems, shared mental models) while reducing cognitive constraints (Leibiere and Anderson, 2011). These processes are monitored by the team coach, the PO, who helps by assuring that a psychologically safe environment is achieved and maintained. Confirming that each team member has an opportunity to be heard and considered. Also, team members can develop a team charter and agree upon the team's definition of Done (exchange theory; see Johnson *et al.*, 2002).

The team of POs aligns the goals for the MTS. This alignment not only assures that each DT's goals are compatible with the MTS's goal, but also that the suitableness across all DTs is in congruence with one another and with the MTS's goal (MTS-social identity theory; current study). In a meta-MTS, this alignment occurs at two different levels. The team of POs aligns the goals for each DT as well as for their MTS, while the team of CPOs assures that the goals are congruent between the MTSs and the meta-MTS. Overall compliance is monitored and approved by the executive facilitator for a meta-MTS structure (MTS-social identity theory).

The literature recommends building a collective identity among team members that reduces inter-team rivalries (hypercompetition; see Power and Alison, 2017). Overcoming a lack of cooperation and cohesion among team members, collective identity aids in building mutual trust and a sense of belonging (Gerber *et al.*, 2016). Shared leadership begins to develop as team members identify with their team, providing them self-assigned roles and responsibilities, furthering their sense of belonging. By extension, team member exchanges with the PO give them an understanding of the overall MTS's goals and coordination with other DTs (MTS-social identity theory), providing team members with a sense of belonging and a belief that they are part of a larger multilevel system. The PO also balances product team member's identity with their team and with the larger MTS to prevent any disassociation or hypercompetition from forming. The goal is for the PO to have each team member have a sense of identity with both their DT and with the MTS, at the same time.

One of the primary goals for the PO is to build trust among team members and to develop a level of confidence in the whole MTS. Building this trust is part of the PO's team coaching role of monitoring and promoting teamwork, allowing for the emergence of camaraderie and cohesion to form. The team of POs builds a sense of MTS camaraderie within each DT to reduce any inter-team rivalries from occurring. As shared resources can often be a point of conflict between teams, the team of POs is required to coordinate and schedule availability of resources so that each DT has the resources needed to complete their goals. For meta-MTSs, the team of CPOs is responsible for assuring that each team of POs has their sense of belonging to the larger meta-MTS so that they can coordinate the MTS's activities accordingly, extending not only the alignment of goals from the MTS to the meta-MTS, but also the sense of belonging from the MTS to the meta-MTS.

8.2 Structuring a MTS model for TC

Most projects that TC are involved in include some form of coordination with similar departments in other organizations. These cross-organizational MTS efforts come with their own set of problems and have been challenging to manage with no actual structure for cross-organizational MTSs available to TC. The cross-organizational MTS model provided in Figure 5 presents a mirroring model for projects involving TC. This mirroring model provides an MTS structure for both TC and an external organization (ORG2 in Figure 5) that includes similar departments from both organizations. Each organization works on the project within an MTS, identical to the one presented in Figure 3, providing the same leadership, responsibilities and roles for the MTS. Resulting in one MTS for TC and one MTS for the second organization. The difference is in how these two organizations coordinate activities between their MTSs. Here, TC's facilitator and the external organization's facilitator are both members of the executive team. This executive team either could be a full executive board or it could be one executive team member in addition to both facilitators. Facilitation assures that each CPO is conscious of the cross-organizational goals. Each CPO is aware of the DTs' proximal goals. Coordination of the proximal goals to achieve the cross-organizational goals comes from the team of POs. By mirroring the MTS across each organization, the executive team can assure the organizations' requirements are being addressed.

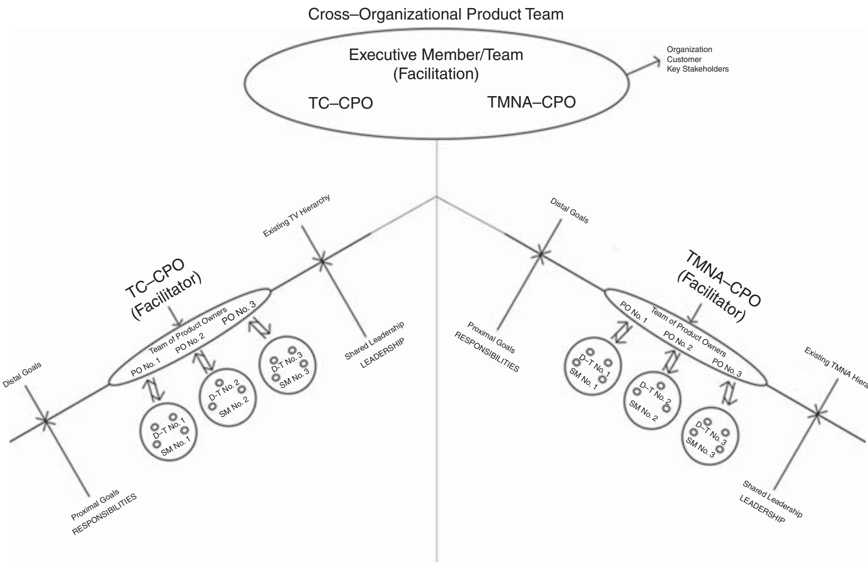

Figure 5.
Cross-organizational MTS model

This cross-organizational MTS model is just one example of structuring a cross-organizational MTS effort. This model follows the organizational MTS example that included an alliance between two pharmaceutical companies (Marks and Luvison, 2012). The DTs that were active during the cross-organizational MTS project varied depending on the stage in the process. Similar to the way the pharmaceutical MTS changed during its phases, the number of DTs operating in each MTS (TC-MTS and ORG2-MTS) changes as the needs for each stage changes. This determination is to be made by the executive team. The model presented here is just one example of a cross-organizational MTS model. To further define this cross-organizational MTS model, future research is recommended.

9. Discussion

The field of MTSs is new and continues to expand as more organizations and industries begin to restructure to accommodate team-based systems compared to the traditional hierarchical systems of yesterday. Organizations are moving away from hierarchical structures and "advocating empowerment, self-management, shared leadership and team-based designs" (Mathieu, 2012, p. 511). However, being a relatively new field of study, there is a little literature available to support organizations as they make this move to team-based systems, especially those involving MTSs. The current study adds to this literature and is one of the major contributions from the study.

Today, a large number of organizations and manufacturing facilities utilize scrum teams in one fashion or another. The current research study highlighted how one organization, TC, employed scrum as one means of becoming more Agile. While there are many variations of a scrum, the best team structure is the one that works for your organization. However, when teams multiply (team of teams, MTS and scrum of scrums) the number of potential problems grows exponentially. As highlighted by Mathieu (2012), "performance problems and safety threats were frequently occurring in the 'cracks' between teams" (p. 512). Scaling of teams is a real problem in today's environment. More literature needs to be made available to aid organizations in their efforts to scale teams. The current study contributed to this effort by providing structure and leadership models for MTSs. One limitation of the current study is that the models presented are theoretical, requiring empirical testing and modifications before being able to show an empirically proven MTS model. Future research is recommended to test these, and other, MTS structural and leadership models.

One problem with expanding the number of teams within an organization is having a lack of focus on teamwork. As found in TC and other scrum and scaling configurations, the effort is on streamlining tasks with a little emphasis on teamwork activities. The current study highlighted structural and leadership components to incorporate more teamwork into these processes, an additional contribution to the field. For example, the models presented in the current study include boundary spanners (Connaughton *et al.*, 2011) and shared leadership (Pearce *et al.*, 2007). Boundary spanners close the "cracks between teams" (Mathieu, 2012), while shared leadership provides team members with the capabilities of setting their own proximal goals, strategies and coordination of activities. This is congruent with the NDM theory (Alison *et al.*, 2015) in that it involves solving real-world problems by those closest to the issues. Use of team-based systems to solve problems and innovation of new products reduce cognitive constraints (Alison *et al.*, 2015) due to the team's cognitive capabilities become more significant compared to individuals. Also, by reducing cognitive constraints, the expected utility (Alison *et al.*, 2015) of the team reduces the occurrence of risk-taking situation by introducing an expansion of knowledge, skills and resources to the problem.

Although the current study identified boundary spanners, shared leadership and team coaching as critical components of effective MTSs, future research is needed to determine the best type of leadership for MTSs. For example, while Pearce presents good coverage of shared leadership (see Pearce 2004; Pearce *et al.*, 2007, 2014), there is a vast and growing body of literature relating to shared leadership that also includes "dispersed, devolved, democratic, distributive, collaborative, collective, co-operative, concurrent, coordinated, relational and co-leadership" (Fitzsimons *et al.*, 2011, p. 313). As a limitation of the current study, full reviews of the literature will be required for each concept (boundary spanner, shared leadership and team coaching) to determine which model works best for MTSs. The current study carried out, however, from the literature relating to MTSs, identify boundary spanners, shared leadership and team coaching as being critical components for future MTS structures. Incorporating these components into the models presented in the current study is one of the benefits of this research, but more research is required.

Perhaps, the most significant benefit of the current research is that it provides, to organizational and industry leaders, full descriptions of what MTSs are, how they are typically structured, and how they are managed. The models presented identify clear boundaries of MTSs. An important consideration when operating in an MTS environment: "it is important to identify the boundaries of MTSs, just as it is important to define the boundaries of any unit of inquiry" (Mathieu, 2012, p. 515). As a relatively new field of study, most perspectives have not recognized MTSs as a new and separate unit of analysis. The current study highlights the key characteristics and boundaries of MTSs as a unit of analysis. For example, there is a clear distinction between the component team's proximal goals (team unit of analysis) and the MTS's distal goals (MTS unit of analysis) that the whole MTS must adhere to in order to achieve the organization's vision (organizational unit of analysis). The models presented in the current study identify these boundaries with means of coordinating these activities within and across teams (component teams and MTS).

At last, the current study highlights a methodology that is designed to work *in-situ* with the customer to define the problem better. A realist systematic review is a methodology that has been successful in the health care industry and is just now beginning to take root in the management and organizational disciplines. The model presented here is only one example of how this collaborative effort could be utilized and is one additional contribution that the current study provides to practitioners, managers and researchers.

10. Conclusion

This systematic review provided the guidelines for problem identification that were utilized to develop the research questions for this study. These guidelines were followed by the researchers in conjunction with the customer, providing better clarity of the problem. This systematic review began the first stage of a more extensive study. Here, both the research location stakeholders and the researchers worked together to merge the literature with current practice to develop newer and better models of conducting business using MTSs for the future. Future research studies will involve testing the models presented in this research study.

As a new field of research, MTS is an area that will continue to grow but not without its problems. One potential problem includes how to structure, manage and incorporate teamwork into MTSs. The current research study looked at these problems that were being experienced by one such organization. Presented in the current study are models that show how leadership, responsibilities and roles support MTSs. Also, combining shared leadership with an organization's hierarchical structure can become attractive, especially for organizations which are not quite willing to release control of their hierarchical structure just yet. This paper also provided a differentiation between proximal goals (team) and distal goals (MTS). This distinction is required to allow for alignment between two different processes involved in an MTS. Characteristics of teamwork are included in each MTS model to assure that team members develop a sense of identity and belonging toward their team and, ultimately, toward the MTS and organization. Including team coaching allows team members to concentrate on taskwork, while team coach focuses on teamwork activities.

Overall, the models presented in the current study provided a means of structuring MTSs. There is no one way to structure an MTS; each organization will need to identify which method works best for their organization. However, starting with a structure for MTSs that incorporates teamwork into the model is an excellent start for any organization. This follows with what McChrystal *et al.* (2015) stated when discussing adaptive MTSs: "Their structure – not their plan – was their strategy" (p. 103).

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