The Journal of Systems and Software 164 (2020) 110545

Contents lists available at ScienceDirect

The Journal of Systems and Software

journal homepage: www.elsevier.com/locate/jss

In Practice

The effect of transactive memory systems on process tailoring in software projects: The moderating role of task conflict and shared temporal cognitions

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ARTICLE INFO

Article history:
Received 31 July 2019
Revised 10 January 2020
Accepted 10 February 2020
Available online 15 February 2020

Keywords:
Software process tailoring (SPT)
Transactive memory system (TMS)
Task conflict
Shared temporal cognitions (STC)
SPT effectiveness
SPT efficiency

ABSTRACT

Contemporary software projects are unique and volatile, leading development teams to modify standard development processes and continue to make adjustments as needed. Adjusting software project development to accommodate the variance and dynamics is called software process tailoring (SPT). Because SPT critically determines how projects are conducted, its performance merits investigation. However, the extant literature lacks empirical evidence of the underlying effects that operate and influence the performance of SPT. Specifically, SPT is a team-based activity that requires the exchange of knowledge and opinions among members to yield an integrative tailoring solution; SPT is also a highly conflicting process involving task and temporal conflicts. Given these characteristics, teams' operational mechanisms that increase SPT performance remain unknown. To address the aforementioned gaps, this study adopts the transactive memory systems (TMS) theory to develop a research model to explore how a team's TMS affects SPT performance with task conflict and shared temporal cognitions (STC) acting as moderators. By examining 102 software project teams, we found that TMS has a positive impact on SPT performance. Surprisingly, task conflict reduces the effect of TMS on SPT performance, whereas STC amplifies the influence of TMS-SPT performance.

1. Introduction

In software development, organizations typically have ad hoc process standards for software projects to ensure the consistency and quality of development (Fitzgerald et al., 2003; Park et al., 2006; Lee et al., 2018). However, faced with the volatile nature of software development, software teams need to alter and adapt their process to fit projects' particularities and dynamic environment (Fitzgerald et al., 2003). The activity of customizing standard software development processes to meet projects' needs is called software process tailoring (SPT) (Ginsberg and Quinn, 1995; Fitzgerald et al., 2003; Xu and Ramesh 2007, 2008; Tripp et al., 2018; Campanelli et al., 2018). SPT plays a critical role in contemporary software development environments, including sequential (e.g., waterfall) or iterative (e.g., agile) development modes when deviation from the standard or planned process occurs (Xu and Ramesh 2007; Park and Bae, 2013; Conboy and Fitzgerald, 2010; Bass, 2016; Campanelli et al., 2018). In particular, SPT promotes evolutionary software development, suggesting that projects may need to update their development in response to changing business environments and software project dynamics (Kawalek and Leonard, 1996; Clarke et al., 2015).

From a team management perspective, software teams play a core role and are primarily responsible for SPT execution and implementation. Teams that conduct tailoring tasks need to achieve superior performance of SPT. This is because performance, in terms of the quality of tailoring decisions and the efficiency of tailoring efforts, may influence project outcomes and results (Xu and Ramesh, 2008; Park and Bae, 2011). In the literature, most SPT research can be classified into two streams. In the first stream, studies aim to develop appropriate technical tailoring methods (e.g., Ahn et al., 2003; Park et al., 2006; Park and Bae, 2013; Alegria et al., 2014). The second stream refers to the study of tailoring guidelines and criteria (e.g., Chou and Chen, 2000; Donzelli, 2003; Lycett et al., 2003; Xu and Ramesh, 2007; Conboy and Fitzgerald, 2010; Bass, 2016; Tripp et al., 2018; Campanelli et al., 2018). These studies tend to focus on the content of SPT. Because an organization's behavior is the key determinant of the success of the activities that it performs (Gavetti et al., 2012; Kotlar et al., 2018), research on SPT performance should logically

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https://doi.org/10.1016/j.jss.2020.110545

begin with and scrutinize the behaviors of the software project teams that operate SPT. However, in the SPT context, the association between teams' operations and behaviors and SPT performance remains unknown. Accordingly, this study attempts to advance the current understanding of teams' operational mechanism in achieving higher levels of SPT performance.

The essence of SPT is knowledge- and learning-intensive. It requires team members, as task owners with diversified domain knowledge, to integrate, collaborate and mutually learn to make suitable tailoring decisions regarding project tasks. In this regard, the team's knowledge-based operational mechanism is crucial, and the team's transactive memory system (TMS) may play a critical role. Theoretically, TMS typically indicates that team members have a shared understanding of where specialized knowledge exists in the team, thereby effectively integrating team members' distributed and complementary expertise (Lewis and Herndon, 2011; Argote and Hora, 2017; Simeonova, 2017). Existing studies have demonstrated that TMS can enhance team performance; however, most studies emphasize investigations of general teams' TMS (e.g., Choi et al., 2010; Lee et al., 2014; Peltokorpi and Hasu, 2016; Huang and Chen, 2018; Wang et al., 2018; Cao and Ali, 2018). In contrast to the general team setting, software teams have dynamic compositions and are formed temporarily. Therefore, several studies have investigated the effects of TMS on software teams and showed the benefits of effectively sharing and integrating knowledge in collaborative project development (Hsu et al., 2012; Lin et al., 2012; Chen et al., 2013; Ryan and O'Connor, 2013). However, as SPT is a special type of teamwork involving conflicts and diverse temporal perspectives of members in planning development, the precise role of the TMS in software teams in the SPT context should be further investigated.

Specifically, SPT is a collaborative activity that requires members to reciprocally coordinate their distinct tailoring missions, tasks and specialized knowledge. However, performing SPT may involve two types of conflicts within a software team, namely, task conflict and temporal conflict. Specifically, task conflict refers to team members' different viewpoints and opinions regarding group task execution and implementation (Jehn, 1997), which affect team learning, decisions and performance (Jehn and Mannix, 2001; De Wit et al., 2012; De Clercq et al., 2015). In SPT, in addition to members' different professional roles/positions (e.g., software developer and tester) that may cause task conflicts (Sawyer, 2001; Liang et al., 2010), how to handle and rearrange the upstream and downstream processes of tailored tasks often arouse critical concerns or even disagreements among the interdependent task owners. In this context, a contextual role of task conflict may impact teams' operational mechanisms (i.e., TMS) when conducting SPT.

In addition, team members often have different temporal perspectives and propensities (Mohammed and Nadkarni, 2011, 2014), which may trigger temporal conflicts (Standifer et al., 2015; Santos et al., 2016). During SPT, such conflicts are amplified because the process involves disputes among members about time-related issues, such as different perceptions of schedules and deadlines, different pacing styles to accomplish a tailoring activity and members' different views regarding the length of task durations. Temporal conflicts may decrease a software team's synchronization and coordination (Gevers et al., 2006) in performing SPT. In other words, when task owners establish a similar time perspective and possess shared temporal cognitions (STC) (Gevers et al., 2006; Mohammed and Nadkarni, 2014), their time-based viewpoints and preferences concerning the work of SPT and tailored tasks can be aligned and matched. Thus, we focus on STC to explore how it exerts a contextual effect in tailoring results and outcomes. Specifically, given that temporal conflicts may occur within the team and TMS reflects the members' cooperative perceptions, we consider STC a moderator and examine it to determine how STC influences the effect of TMS on SPT performance.

In this context, three research questions are considered in this study. (1) Does a software team's TMS contribute to SPT performance, and if so, how? (2) Does task conflict moderate the effect of TMS on SPT performance, and if so, how? (3) How does the moderating role of STC influence the relationship of TMS-SPT performance? To answer these questions, a research model comprising several hypotheses is developed. The remainder of this study is organized as follows. Section 2 reviews relevant studies on the research subject. Section 3 proposes the model and the hypotheses. The research methodology is presented in Section 4. Section 5 examines the model and the corresponding hypotheses. Section 6 discusses the theoretical contributions and practical implications. Finally, limitations of the paper and future research directions are presented.

2. Theoretical background and literature review

In this section, we review the theoretical background and literature relevant to the study. Specifically, we first review software process tailoring (SPT) and the definition of SPT performance. Since this study explores the effects of a transactive memory system (TMS) on software teams performing SPT, we proceed to review the theoretical contents of TMS. Then, we explore the concepts of task conflicts and shared temporal cognitions (STC), which are involved in SPT, as subsequently, we further determine their moderating effects in the quest of TMS in the SPT context.

To enhance clarity for the readers, in the following table, we provide brief definitions of SPT, SPT performance, TMS, and STC in a tabular format with references for further reading.

2.1. Software process tailoring and its performance

The nature of software development is dynamic and fickle. Software projects have unique characteristics, such as the diverse requirements of customers, the technical complexity, and different sizes and scopes of projects. Therefore, no single software process can be fully applied to all projects (Slaughter et al., 2006; Xu and Ramesh, 2008). In this sense, software processes need to be tailored to accommodate a particular project's requirements and environments (Xu and Ramesh, 2007; Park and Bae, 2013). Specifically, SPT includes four steps (Xu and Ramesh, 2008). The first step refers to the assessment of project goals and environments, which means that a software project team may need to adjust the project environment (e.g., budget, schedule, personnel) and project goals (e.g., the purpose of the software product and the derived quality requirements) to ensure consistency between the two.

The second step is to assess the resulting impacts due to tailoring. These impacts include corresponding changes or bad-fixes on other processes to be modified and the resources, budget and personnel to be rearranged for the modified processes. The third step refers to identifying strategies of process modification to mitigate the impact of change. Tailoring strategies include, but are not limited to, the decision to expand, delete, replace, or simplify process elements. These strategies are used to alter the form, frequency, granularity and scope of process elements to make the process suitable for a specific project environment (Ginsberg and Quinn, 1995). The final step includes validation and evaluation of the process tailoring. Specifically, this step refers to the assessment of the influence on the project outcome after the implementation of the tailoring decision (Park and Bae, 2011).

Although software development is collaborative in nature, conducting SPT is a challenging process. These challenges are twofold. First, in addition to the distinct characteristics of team members, conflicts primarily stem from their interdependent work relationship in development (Sawyer, 2001; Liang et al., 2010). Such conflicts are addressed in a later section. Second, the SPT is a knowledge-intensive activity that requires the team to possess and handle a great deal of product, process or project knowledge. Product knowledge is knowledge regarding the product or software features and how they relate to other products, standards, and protocols. Project knowledge refers to knowledge about resources, deliverables, timing, milestones, increments, and quality targets. Process knowledge denotes knowledge about business processes, workflows, responsibilities, supporting technologies and interfaces between processes (Ebert and Man, 2008).

To measure the performance of SPT, Xu and Ramesh (2008) defined two distinct components, the effectiveness and efficiency of the process tailoring action. The effectiveness of process tailoring reflects the quality of a software team's tailoring decision, or how the decision meets the intended expectations and contributes to the project outcome. The efficiency of process tailoring denotes how much effort is made by the team in conducting the tailoring tasks. Studying the performance of SPT is important for teams because it allows members to better understand how their individual contributions and interactive learning affect the collaborative tailoring decision, which in turn impacts the consequences of the project outputs. Accordingly, in the next sections, we explore TMS and investigate how a team's TMS is associated with SPT effectiveness and efficiency. In the study of this association, we take a conflict perspective and consider that the two moderating roles (i.e., task conflict and STC) may influence TMS-SPT effectiveness and TMS-SPT efficiency.

2.2. Transactive memory systems (TMS)

A transactive memory system is a shared system that people in relationships develop to encode, store, and retrieve information about different substantive domains (Ren and Argote, 2011, p. 191). TMS can be regarded as a collaborative division of labor to allow a team to learn, remember and communicate knowledge from distinct knowledge domains (Wegner et al., 1991; Lewis and Herndon, 2011). The development of TMS depends on frequent interactions and communications among individuals. Through TMS, team members can perceive who knows what and how (Faraj and Sproull, 2000; Ren and Argote, 2011; Nevo et al., 2012). Team members can obtain other's knowledge and know-how by establishing a positive social interaction process (Choi et al., 2010; Lewis and Herndon, 2011; Huang and Chen, 2018). In the literature, Gino et al. (2010) found that TMS increases teams' learning ability because individuals can effectively learn from their team members and then disseminate this knowledge and expertise to the entire team. Moreover, TMS facilitates a cross-understanding of teammates' distributed knowledge, which can help in better coordinating and applying the knowledge to tasks (Li and Huang, 2013; Huang and Chen, 2018).

TMS enables teams to recognize every members' knowledge and its professional domain; therefore, it can enhance a team's information collection and synthesis (Whelan and Teigland, 2013). TMS provides multiple benefits for teams. First, when team members possess a shared understanding of who is suitable to provide what knowledge and expertise, the team's ability of information retrieval will become faster and more effective. Second, when teams encounter new information or knowledge, TMS can quickly allocate this information to the proper members; hence, the team can effectually retrieve it when it is needed in the future (Argote and Hora, 2017). Consequently, TMS can improve a team's collective performance by reducing the time and effort required to seek and obtain necessary know-how and expertise to accomplish the team's tasks and goals.

In the SPT context, conducting tailoring tasks involves the redesign of various and interdependent professional tasks and procedures. Thus, it requires intensive knowledge exchange and transfer among team members. In the literature, existing TMS studies mostly emphasize general teams' TMS (e.g., Choi et al., 2010; Lee et al., 2014; Peltokorpi and Hasu, 2016; Huang and Chen, 2018; Wang et al., 2018; Cao and Ali, 2018). In software development environments, however, the composition of the software project team is dynamic and temporary. Such a team setting, in addition to the aforementioned conflictual nature of the SPT process, may lead to discrepancies between the nature of SPT and the harmonious development of TMS. In this situation, it remains unknown whether a software team's TMS exerts an effect on SPT tasks. Therefore, this study attempts to investigate and examine how TMS influences the performance of SPT.

2.3. Task conflict

Task conflict refers to differences in viewpoints, ideas, and opinions pertaining to group tasks (Jehn, 1997; Jehn and Mannix, 2001; De Wit et al., 2012; De Clercq et al., 2015). Task conflict arises when tasks and their contextual knowledge are not fully shared or are viewed from different viewpoints by team members. Task conflicts may lead to dysfunctional or functional outcomes within teams (Crawford et al., 2014). From a dysfunctional perspective, task conflict may lead to reduced dissatisfaction and commitment or to unnecessary increased costs to the team (Jehn, 1997; Simons and Peterson, 2000; Jehn and Mannix, 2001; Karn and Cowling, 2008). Communication and coordination among individuals and groups may also be decreased due to task conflicts (Foo, 2011; Puck and Pregernig, 2014; Humphrey et al., 2017), thereby affecting the outcome of the project (Crawford et al., 2014). However, task conflict may also contribute to positive and functional consequences. For example, teams can benefit from differences in opinion about the work or various ideas on certain subjects, which may stimulate innovation, creativity, and growth (Crawford et al., 2014). Teams that experience task conflicts may improve their decision quality because such conflicts encourage greater cognitive understanding of the issue at hand (Jiang et al., 2012; De Wit et al., 2012). In addition, task conflicts can enhance a team's learning and improve group productivity by incorporating devil's advocacy roles and constructive criticism (Jehn, 1997; Liang et al., 2010).

In software development, SPT is a conflicting process. Specifically, during SPT implementation, task conflicts may exist among team members with different roles/positions and job missions. For example, software developers and testers must accomplish designated tasks based on their respective responsibilities. Developers usually expect to complete tasks with the least effort to seek maximum "efficiency". In contrast, testers generally seek to maximize "effectiveness" and expect to achieve the best quality when delivering the final product (Sawyer, 2001). Process tailoring usually arouses corresponding alterations and associated impacts on the job and task missions of members who are mutually independent due to their task sequence. When upstream tasks are tailored, such as to delete the planned outputs of some tasks, such modification often causes critical concerns or even disagreements from other members who are in charge of the downstream tasks. Because SPT is teamwork and given the aforementioned task conflict in SPT, it remains unknown whether its contextual effect has a positive or negative impact on the link between TMS and SPT. In this regard, under task conflict circumstances, the way the team's TMS affects SPT performance should be further identified. Thus, this study attempts to use task conflict as a moderator to explore and investigate its effect on TMS-SPT performance.

2.4. Shared temporal cognitions

Shared temporal cognitions (STC) refers to a shared understanding among team members regarding the time-related aspects of a collective task execution, such as meeting the deadline, (sub)task completion times, and the pacing style of task implementation (Gevers et al., 2006; Mohammed and Nadkarni, 2014; Santos et al., 2016). STC helps members to have a similar attitude, orientation and perspective on time and to foresee and comprehend each other's actions and thus to adopt more compatible work patterns (Gevers et al., 2006). This may reduce the temporal diversities and differences among members, contributing to higher levels of temporal synchronization and enhancing the harmony and coordination of group task activities (Mohammed and Nadkarni, 2011; Uitdewilligen et al., 2013; Santos et al., 2016). Scholars have shown that STC helps streamline team processes, which in turn benefits team outcomes (Gevers et al., 2006; Mohammed and Nadkarni, 2014; Santos et al., 2016). For example, Santos et al. (2016) indicated that STC act as temporal norms and informal regulations to govern members' time-based behaviors, such as the pacing style (Alipour et al., 2017). Therefore, SPT decreases the extent of temporal and process conflicts, thereby increasing team performance.

As mentioned above, SPT is a conflicting process. Moreover, the heterogeneity of members also imposes temporal diversities and differences on a team (Mohammed and Nadkarni, 2011, 2014). Because of the distinct temporal personalities of team members, future tasks or missions at the same time distance result in members' different ideas and perceptions, which in turn lead to different behaviors and decisions (Liberman and Trope, 1998; Trope and Liberman, 2003). For example, the duration of the residual half-month of a software project can be expressed as "the remaining half of a month" as a positive temporal frame or "still having a half month" as a negative temporal frame (Paese, 1995). In this case, with the same time limit, individuals will have different perceptions, orientations and cognitions due to different temporal frames (Kees, 2010). These different temporal construal effects may lead to temporal conflicts among members (Gevers et al., 2009; Standifer et al., 2015; Santos et al., 2016) when performing tailoring tasks. Moreover, because of the diversified specialties of work and the collaborative nature of software development, the adjustment and redesign of project tasks requires collective coordination in the team. This also means that team members must accommodate each other's temporal cognitions to reach consensus to ensure that the intended output, during times of process change, can still be carried out as expected and with team effort (Gevers et al., 2006). Given that temporal conflicts that may exist in teams and because TMS relies on a well-coordinated team environment, the way that STC are contextually exerted on the mechanism of a team's TMS for an effective and efficient SPT decision is unknown. Therefore, this study explores and investigates the moderating effect of STC on TMS-SPT performance.

3. The development of a theoretical model

The research model is developed by examining the constructs of TMS, task conflict, STC and SPT performance, as shown in Fig. 1. The development of the model is described in the following sections.

3.1. The effect of TMS on SPT performance

The development of a software project involves various types of knowledge and communication in different professional fields, such as engineering, administration, design, process assurance and other management expertise (e.g., legal, customer relations) (Lin et al., 2012). This complex and dynamic interaction and knowledge exchange may be amplified when conducting SPT that is conflicting in nature. Furthermore, the composition of the software project team is diverse and complementary, so the knowledge dependence among team members is significant. In theory, TMS facilitates the precise identification of every member's specialized domain and expertise and then building an effective knowledge network within a team. Such a knowledge network effectively streamlines the exploration and identification of SPT knowledge that is mutually complementary.

Performing SPT requires the team to possess and handle a great deal of knowledge (i.e., product, process or project knowledge). From the theory of bounded rationality and the perspective of information overload, humans have only a limited capacity to absorb and process massive information or knowledge (Ellwart et al., 2015; Laker et al., 2017). In other words, individuals may receive enormous knowledge without effectively identifying, justifying and understanding it. This will limit their cognitive processing ability to address and utilize the knowledge, thereby decreasing the quality of their decision-making (Speier et al., 1999; Ellwart et al., 2015; Laker et al., 2017). Because software development is conducted in teams, if information overload occurs, it may limit and decrease the team's processing ability in terms of the recognition, analysis, application and integration of knowledge. This is especially true when conducting knowledge-intensive SPT that may result in unilateral or fragmentary tailoring decisions. Nevertheless, with the assistance of TMS, the SPT process is facilitated by strengthening the knowledge identification capacity of expert members. Each member can concentrate on his/her domain-specific acquainted knowledge while collaboratively composing the knowledge network to produce a holistic tailoring decision. TMS is expected to lead team members in a natural way to replenish appropriate and conversant individual knowledge areas in the grand scheme of the tailoring needs. Thus, members' work can be mutually adjusted based on their complementary knowledge that is deficient in others (Whelan and Teigland, 2013). In this sense, TMS decreases the possibility of information overload at the team level when performing SPT and enables the team to make better tailoring decisions. Thus, we propose the following:

Hypothesis 1. *TMS has a positive influence on the efficiency of SPT.*

Hypothesis 2. *TMS has a positive influence on the effectiveness of SPT.*

3.2. The moderating role of task conflict

Prior research has demonstrated that task conflict acts as a double-edged sword for team performance. De Dreu and Weingart (2003) indicated that nonroutine tasks are typically complex tasks without standard solutions that require more comprehensive interaction and exchange of information and opinions within a team. From the positive side, task conflict can allow team members to scrutinize task issues and to engage in depth when processing task-relevant information. This nurtures the team's capability to develop creative insights and make better decisions (Jiang et al., 2012; De Wit et al., 2012; Crawford et al., 2014). Because the dynamic nature of SPT and tailoring cases are distinct and diverse, performing tailoring tasks often involves nonroutine schemes and decisions. In this regard, task conflict may enable members to have divergent thinking that allows them to re-evaluate and reflect on the status quo and to produce more appropriate tailoring decisions and strategies for the scenario of the task. Therefore, this study adopts task conflict as a positive contextual effect on the relationship between TMS and SPT performance.

Debate or even disagreement regarding the team's tailoring task spurs greater knowledge and information sharing of divergent per-

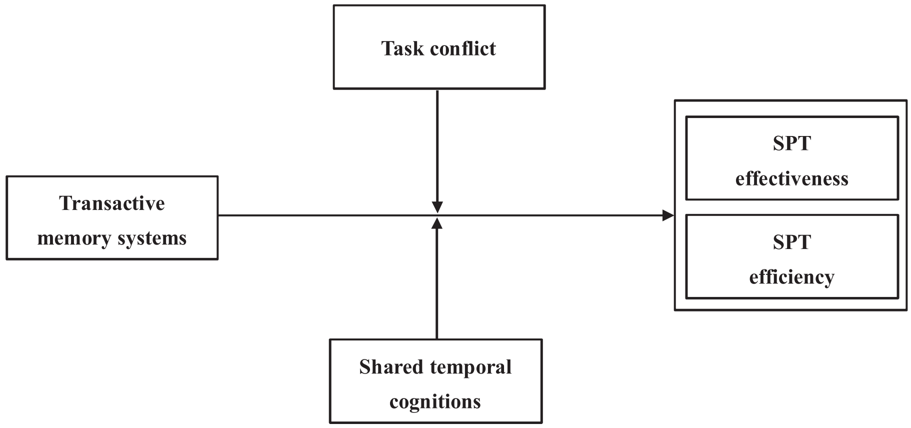

Fig. 1. The research model.

spectives and positions, which leads to the increase of members' mutual understanding of specialized knowledge and improves the quality of group decisions (Jehn and Mannix, 2001; De Dreu and Weingart, 2003; de Wit et al., 2012). In this sense, with regard to SPT, task conflict promotes a deeper comprehension of tailoring targets for certain tasks and yields more profound consideration from different members who conduct subsequent tasks that might be impacted by the change. Therefore, the quality in terms of the effectiveness of tailoring decisions can be improved through more intensive interactions and negotiations among members. Moreover, task conflict that entails enhanced interaction within the team may synthesize members' diverse perspectives and knowledge and improve the team's knowledge network, thereby boosting the dissemination of SPT knowledge when performing SPT tasks. This may decrease the members' acquisition cost of SPT knowledge and allow the team to streamline the flow of SPT knowledge required to conduct SPT. In this sense, task conflict may exert a positive effect on the team's TMS for SPT effectiveness and efficiency. Accordingly, we propose the following:

Hypothesis 3. *Task conflict positively moderates the effect of a software team's TMS on SPT effectiveness.*

Hypothesis 4. *Task conflict positively moderates the effect of a software team's TMS on SPT efficiency.*

3.3. The moderating role of shared temporal cognitions

With regard to SPT, the time remaining in a project determines how a software team reschedules and redesigns the project. In this context, STC enable team members to be in the same temporal frame regarding the length of project schedules and to have a common understanding of time-based perspectives on executing collective tasks. High levels of STC indicate that members possess equal temporal considerations (Gevers et al., 2009; Mohammed and Nadkarni, 2014) regarding the tailoring decision, including agreement on the pacing style and meeting temporal milestones, how the work should be scheduled over time through times of process alterations, and agreement regarding when to start and finish the work on tailored tasks. Therefore, the team's "temporal dynamics" (Mohammed and Nadkarni, 2014) are reduced, and the members can better organize and align time-related concerns to reach a decision. This improves members' shared sense of the peripheral knowledge related to the tailored tasks and subsequent tasks because members can more accurately understand others' specialized knowledge and skills in relation to these tasks at different points in time during the project. Thus, the team's TMS may be enhanced, which in turn yields a more comprehensive scheme for tailoring decisions.

Moreover, scholars have indicated that coordinative efforts are most effective when the temporal perspectives and behaviors of team members are aligned (Gevers and Peeters, 2009; Standifer et al., 2015). In SPT, this may synchronize the timing of knowledge processing to the tailoring work. Specifically, increased coordination and time-based compatible behavioral patterns promote a flow of knowledge that composes, aggregates, diffuses and permeates among the members, thus streamlining the discussion process during SPT. Conversely, when team members perceive time distance and time frames differently, the members may suffer mismatch and disrupted knowledge interactions, and they may have difficulty reaching a consensus regarding how tasks are adjusted and rescheduled. This may reduce the flow of knowledge transmission and transfer when performing SPT tasks. In this sense, STC improves the shared sense among members when knowledge is needed to support and contribute to the flow because members can more accurately participate in the discussion process of SPT. Thus, when a high level of shared STC exists within a software team, its TMS could be strengthened, which leads to the efficient exchange of SPT knowledge during process tailoring. In other words, the effect of the team's TMS on the efficiency of SPT could be reinforced by STC. Therefore, we propose the following:

Hypothesis 5. *Shared temporal cognitions positively moderate the effect of a software team's TMS on SPT effectiveness.*

Hypothesis 6. *Shared temporal cognitions positively moderate the effect of a software team's TMS on SPT efficiency.*

4. Research methodology

4.1. Data collection and sample

In this study, a survey method was adopted to empirically validate the research model. Because our target samples were software project teams in Taiwanese firms and the original versions of the instrument were in English, we applied a backward-translation procedure to translate the instrument into Mandarin. Specifically, one researcher first translated all questionnaire items from English to Mandarin, and then, another researcher independently back translated the Mandarin version to English. We compared the two English versions and made necessary changes to the Mandarin questionnaire to ensure translation accuracy (Xiang et al., 2013; Jiacheng et al., 2010). Before the formal data collection, we first invited three experts (two professors and one senior industrial specialist) who were familiar with software development and management information systems to participate in the development of the questionnaire and examine the measurements pertinent to the SPT domain. This also ensured that the measurement items were ex-

Table 1
Definitions and abbreviations of the terms used in this study.

Software process tailoring (SPT)	The activity of customizing standard software development processes to meet projects' peculiarities and volatility (Fitzgerald et al., 2003; Xu and Ramesh 2007; Campanelli et al., 2018)
SPT performance	SPT performance refers to the efficiency and effectiveness of SPT. Specifically, SPT effectiveness is defined as the quality of tailoring decisions, and SPT efficiency refers to the effort needed during process tailoring (Xu and Ramesh, 2008)
Transactive memory system (TMS)	A collaborative division of labor allowing a team to learn, remember and communicate knowledge from distinct knowledge domains (Wegner et al., 1991; Lewis and Herndon, 2011)
Shared temporal cognitions (STC)	A shared understanding of the time-related aspects of a collective task execution (Santos et al., 2016) to avoid diverse temporal frames (Kees, 2010) or different temporal construal effects (Trope and Liberman, 2003)

Table 2
Sample distributions in this study.

Number of delegating teams per organization	Number of participating organizations
1	28
2	37
Number of responding team members per team	Number of participating teams
2	72
3	28
4	2

pressed clearly and meaningfully. Next, a pilot testing process was performed with ten software project professionals to ensure the readability and understandability of the questionnaire items. This process helped to finalize the formal questionnaire (Table 1).

The initial sampling frame consisted of the top 100 organizations in Taiwan. We first contacted these organizations by e-mail or telephone and explained the study's purpose to them to ensure that they understood and agreed to participate. We also ensured that the participants were serious about answering the questions. Of the 100 organizations contacted, 65 were willing to participate in the survey. The unit of analysis in this study was the team, and the target population was software teams that were directly involved in SPT. To avoid single-source bias and common methods in each software team, we asked one team manager and at least two team members who were familiar and knowledgeable with the SPT context and had experienced and undertaken process tailoring tasks to complete the questionnaires. Specifically, an ex-ante common method bias (CMB) approach was used in which team members rated TMS, task conflict, and STC and team managers rated SPT performance. Survey data from managers and members were also collected at two different time periods separated by six weeks. Moreover, respondents were asked to evaluate the properties and behaviors of the team and were required to understand the entire team operation. All respondents were assured that their responses would be kept confidential. The survey was conducted by e-mail, and 102 software teams (including 102 team managers and 236 members) participated in this survey. Therefore, a total of 102 matched samples were included in the data analysis. The sample distributions and demographics are shown in Tables 2 and 3, respectively. According to Table 2, several teams (2 in this study) have four participating respondents and might confound the results. We confirmed that eliminating this portion of the data did not significantly affect the results and, thus, did not threaten the internal validity of the survey data.

Table 3
Characteristics of the study sample.

Item		Number	Percentage
Respondent information			
Respondent position	Team leader/Project manager	102	30.2%
	System analyst	35	10.4%
	System architect	25	7.4%
	System designer	21	6.2%
	System developer	122	36.1%
	Tester	33	9.8%
Software project information			
Team size	Less than 5	34	33.3%
	6–10	28	27.5%
	11–15	15	14.7%
	16–20	8	7.8%
	21–25	11	10.8%
	Over 26	6	5.9%
Project duration	Less than 3 months	29	28.4%
	4–6 months	38	37.3%
	7–9 months	15	14.7%
	10–12 months	12	11.8%
	13–24 months	5	4.9%
	Over 25 months	3	2.9%
Industry	Software	51	50.0%
	Communication	21	20.6%
	Electronics	13	12.7%
	Manufacturing and machinery	12	11.8%
	Finance and banking	5	4.9%

4.2. Measures

In this study, the research constructs were modified from the existing literature and measured using a seven-point Likert scale ranging from "strongly disagree" to "strongly agree," as shown in the Appendix. Specifically, TMS was assessed by asking team members to rate their interactions with others within the team. Six items developed by Choi et al. (2010) were applied to measure TMS. Task conflict was assessed using a four-item scale from Liang et al. (2010) to measure the differences of team members' opinions, ideas and goals about the tailoring task of the project within the team. STC comprising four items was used to assess the extent to which team members had similar time-related opinions, thoughts and ideas when performing SPT tasks. The items were adapted from Gevers et al. (2006).

SPT performance comprises two components, SPT efficiency and SPT effectiveness. Specifically, the efficiency of SPT representing the necessary effort to conduct the tailoring task was measured by two items that were adapted from Xu and Ramesh (2008). The effectiveness of SPT refer to the quality of tailoring decisions, and its measurement is grounded on Xu and Ramesh (2008), Slaughter et al. (2006) and Dooley and Fryxell (1999). Moreover, this study applied a referent shift approach to the measurements (Kuenzi and Schminke, 2009; Lee and Chen, 2019a) to alter the focal referent from the organization (i.e., "this firm") to the project (i.e., "the project"). The scale of SPT effectiveness and SPT efficiency was completed by the team leader.

Table 4
VIF values of common method bias.

Constructs	1	2	3	4	5
1. EE		1.698	1.664	1.367	1.615
2. EY	1.215		1.168	1.237	1.23
3. STC	1.726	1.664		1.35	1.743
4. TC	1.727	2.212	1.648		2.085
5. TC	1.136	1.215	1.166	1.152	

4.3. Data aggregation

We aggregated the team members' responses to the team level by examining several statistics to justify aggregation: Rwg (James et al., 1984) and intraclass correlation coefficients ICC(1) and ICC(2) (Schneider et al., 2003). The values of Rwg and ICC(2) were greater than the accepted value of 0.70, and the values of ICC(1) exceeded the threshold of 0.12, indicating a reasonable level of agreement (Schneider et al., 2003). There was support for the aggregation of the following constructs: for TMS, Rwg = 0.84, ICC (1) = 0.30, ICC (2) = 0.85; for task conflict, Rwg = 0.81, ICC (1) = 0.36, ICC (2) = 0.85; for shared temporal cognitions, Rwg = 0.85, ICC (1) = 0.37, ICC (2) = 0.80. Therefore, the team members' ratings were appropriate for team-level aggregation.

4.4. Common method bias

To examine the presence of common method bias, two ex-post CMB approaches were adopted in this study. We first performed a Harman's one-factor test (Podsakoff et al., 2003). The results showed that the variance of the first factor accounted for 33.11%, which was less than 50%, showing that CMB was not a major concern. Next, according to the recommendations of Kock (2015) and Guhr et al. (2018), we employed full collinearity tests by assessing whether all the variance inflation factors (VIFs) were below the recommended threshold of 3.3. As shown in Table 4, all the VIFs of this study did not exceed this threshold. This implied that CMB was not a significant threat in this study.

5. Data analysis and results

The statistical technique of partial least squares (PLS) has been widely used in the software development literature (e.g., Hsu et al., 2013; Romero et al., 2015; Lee et al., 2016; Acikgoz and Gunsel, 2016; Campanelli et al., 2018; Lee and Chen, 2019b) because it is distribution-free (i.e., the estimation is unaffected by the complexity of the model or nonnormality of the data) and overcomes multicollinearity problems (Hair et al., 2013; Lee and Chen, 2019b). Moreover, several studies suggest that PLS is appropriate when the sample size is small (Hair et al., 2019; Ringle et al., 2019; Henseler et al., 2016). The sample size in this study was small (N = 102); therefore, PLS was adopted to examine the proposed model. However, as there is a debate arguing (e.g., Rönkkö et al. (2016)) or promoting (e.g., Hair et al. (2019) and Ringle et al. (2019)) PLS for statistical analysis, the use of PLS may be deemed as a possible threat to the internal validity of this study. In the data analysis section, the first step examined the measurement model to determine the reliability and validity of the constructs, and the second step assessed the strength of the hypothesized links among the variables. In this study, SmartPLS 3 software (Ringle et al., 2015) was used for the analysis. The software is a state-of-the-art PLS program that has been widely used and approved by many scholars. The software not only provides basic analysis options and assessment criteria but also supports advanced model evaluation metrics (e.g., heterotrait-monotrait ratio of correlations, which we used in this study) (Shiau et al., 2019).

5.1. Measurement model

To validate the measurement model, item reliability, convergent validity and discriminant validity were assessed. We first examined individual item reliability based on item loadings between an indicator and its posited underlying factor. If the loading was lower than the suggested acceptable value of 0.5, the item was dropped from the construct (Hair et al., 2013). All retained item loadings were greater than the suggested acceptable value (see Table 2). Reliability was also examined using composite reliability (CR) values. All of the CR values were above 0.7, ranging between 0.871 and 0.927, which is a commonly acceptable range (Hair et al., 2013) (see Table 5). The results showed that all CR values were reliable.

To meet the requirements of convergent validity, the average variance extracted (AVE) for each construct should exceed the threshold value of 0.50, which indicates that 50% or more of the variance is explained by the indicators of the latent variable (Hair et al., 2013). In this study, the AVE values ranged between 0.575 and 0.864, and all values were above the acceptable level of 0.50 (see Table 3). All the factor loadings and AVEs supported the convergent validity of the constructs. To examine discriminant validity, a heterotrait-monotrait ratio of correlations (HTMT) approach was used (Henseler et al., 2016). According to the results (see Table 6), all HTMT values were below the accepted value of 0.90. This implies that discriminant validity was established between the two constructs (Henseler et al., 2016), supporting discriminant validity.

5.2. Structural model

The proposed hypotheses were tested using the bootstrap resampling estimation (5000 resamples) to determine the significance of the paths in the structural model. The test of the structural model consisted of path coefficients and the coefficients of determination (R-squared value). Path coefficients demonstrated the strength of the relationships between the dependent and independent constructs. The R-squared values indicated that the amount of variance was explained by the independent constructs. Fig. 2 shows the test results of the structural path analysis of PLS estimation. The empirical results demonstrated that the hypothesized main effects were supported, supporting H1 ($\beta = 0.442$, $p < 0.001$) and H2 ($\beta = 0.178$, $p < 0.05$). In other words, TMS has significant and positive impacts on SPT effectiveness and SPT efficiency, respectively. Regarding the moderating effects, unexpectedly, the results showed that task conflict negatively and significantly moderated the relationships of TMS and SPT effectiveness and TMS and SPT efficiency, which did not support H3 ($\beta = -0.107$,

Table 5
Descriptive statistics and measurement model results.

Construct	Mean	Standard deviation	Loadings	CR	AVE
Transactive memory systems (TMS)				0.893	0.584
TMS1	5.85	0.92	0.647		
TMS2	5.70	0.85	0.764		
TMS3	5.78	0.89	0.763		
TMS4	5.85	0.86	0.805		
TMS5	5.79	0.89	0.825		
TMS6	5.79	0.90	0.770		
Effectiveness of SPT (EE)				0.871	0.575
EE1	5.71	0.90	0.709		
EE2	5.43	1.02	0.802		
EE3	5.86	0.89	0.840		
EE4	5.79	1.10	0.714		
EE5	5.52	1.10	0.718		
Efficiency of SPT (EY)				0.927	0.864
EY1	4.61	1.42	0.928		
EY2	4.41	1.48	0.931		
Shared temporal cognitions (STC)				0.900	0.692
STC1	5.38	1.13	0.764		
STC2	5.25	1.16	0.873		
STC3	5.20	1.16	0.850		
STC4	5.16	1.21	0.837		
Task conflict (TC)				0.889	0.729
TC1	3.63	1.57	0.854		
TC2	4.53	1.44	0.806		
TC3	4.09	1.45	0.898		

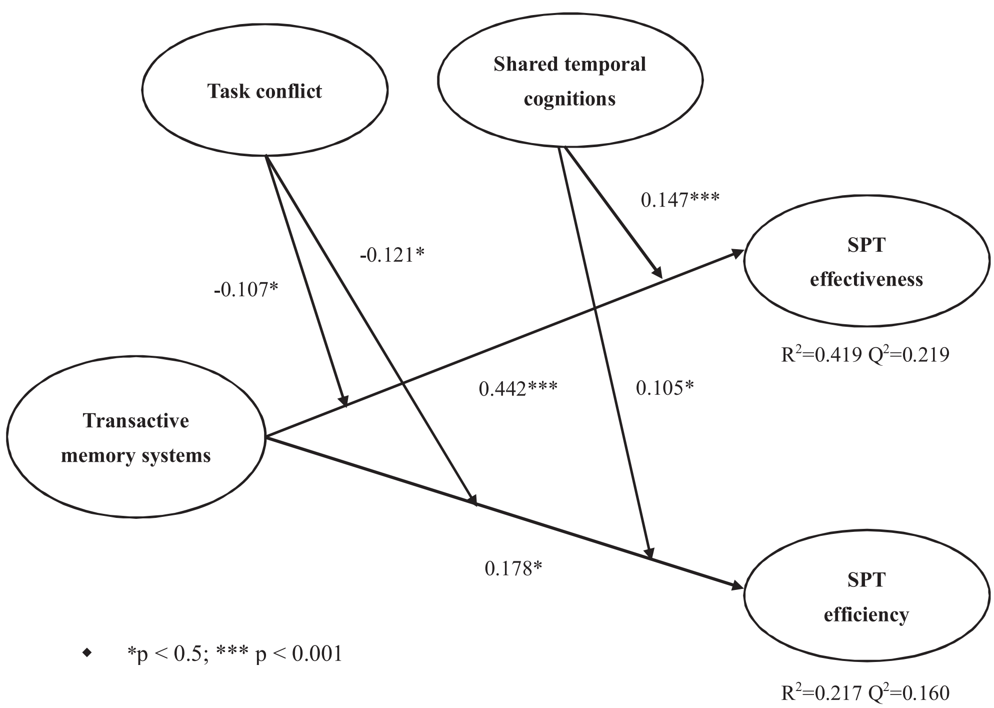

Fig. 2. Analysis of the proposed model.

Table 6
HTMT values of discriminant validity.

Constructs	1	2	3	4	5
1. EE					
2. EY	0.401				
3. TMS	0.516	0.459			
4. TC	0.720	0.389	0.718		
5. STC	0.398	0.265	0.268	0.375	

$p < 0.05$) and H4 ($\beta = -0.121$, $p < 0.05$). Task conflict decreases the effects of TMS on SPT effectiveness and efficiency. These two negative moderating effects will be discussed in the following section. In addition, as we hypothesized, STC positively moderated the relationships of TMS-SPT effectiveness and TMS-SPT efficiency, supporting H5 ($\beta = 0.147$, $p < 0.001$) and H6 ($\beta = 0.105$, $p < 0.05$). In other words, under higher levels of STC, TMS strengthens SPT effectiveness and SPT efficiency, respectively. Fig. 3 illustrates the moderating effects on the relationships of TMS-SPT effectiveness and TMS-SPT efficiency. Moreover, the coefficient of determination (R^2) of the model was 0.419 for the effectiveness of SPT and 0.217 for the efficiency of SPT, as shown in Fig. 2.

In this study, the predictive relevance (Q^2) was also calculated. As shown in Fig. 2, the values of Q^2 for SPT effectiveness and SPT efficiency were 0.219 and 0.160, respectively. All the values of Q^2 were greater than 0, demonstrating that the proposed model

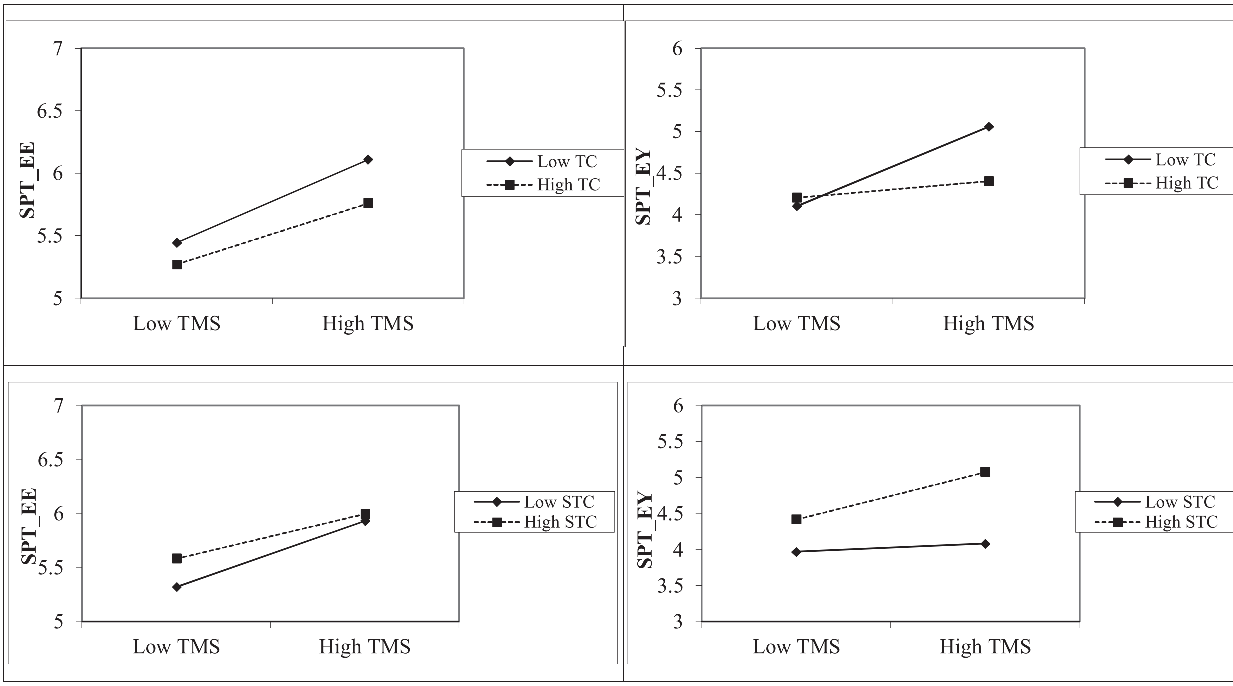

Fig. 3. Factors moderating the effects of TMS on SPT effectiveness and SPT efficiency.

possessed acceptable predictive relevance (Hair et al., 2013). Finally, we examined the model fit using the standardized root mean square residual (SRMR) (Henseler et al., 2016). The result showed that the value of SRMR was 0.06, which is less than the threshold value (0.8), indicating that our model is rational (Henseler et al., 2016).

6. Discussions and implications

6.1. Theoretical contributions

This study makes several theoretical contributions to the extant literature. First, SPT is a knowledge-intensive and team-level activity. From a team management perspective, this study further identifies a software team's operational mechanisms to achieve better SPT performance. Specifically, based on the TMS theory, this paper advances the understanding that the team's TMS has significantly positive influences on SPT effectiveness (i.e., the quality of tailoring decisions) and SPT efficiency (i.e., the tailoring efforts). TMS is able to establish a team's SPT knowledge network and channels by recognizing and integrating members' distributed expertise and helps the team to better explore and utilize mutual knowledge when conducting complicated SPT tasks. This helps to reduce individual members' efforts to absorb identical SPT knowledge. Additionally, with the help of TMS, team members can establish tacit understanding and increase cognitive processing ability, thereby improving highly synergetic SPT decisions. Xu and Ramesh (2008) argued that SPT requires generalized and contextual knowledge. This paper extends their study to suggest that TMS can act as a decentralized knowledge repository with the indexing capability (e.g., via tacit understanding) to store generalized knowledge and to access individual know-how to compose the contextual knowledge specific to the tailoring scenario. In other words, TMS is found to have the ability to help teams effectively form the grand scheme of tailoring references and scenarios.

Second, previous studies have paid extensive attention to the relationship between TMS and team performance (e.g., Choi et al., 2010; Hsu et al., 2012; Li and Huang, 2013; Wang et al., 2018; Cao and Ali, 2018). However, for tasks such as SPT that involve conflict, the moderating effect of task conflict on a team when performing TMS is rarely addressed. We extend these studies to take conflict into consideration because SPT requires team members with different functional roles to produce a shared process on which they can work collaboratively. Hence, our study adopts the functional perspective to hypothesize a positive moderating effect of task conflict on the relationship between TMS and SPT performance. However, the empirical results demonstrate that the effects of TMS on SPT effectiveness and efficiency are hampered by task conflict. This may be because the level of task conflict in this study was relatively high (i.e., the mean of three items measuring task conflict ranged from 3.63 to 4.53 on a 7-point scale; see Table 5). These findings echo the report of an inverted U-shaped relationship between the amount of conflict and team performance (Jehn, 1995, 1997; De Dreu, 2006), implying that too much or too little conflict exerts a negative effect on performance in the SPT context. Moreover, several studies (e.g., De Dreu and Weingart, 2003; De Wit et al., 2012; Crawford et al., 2014) have indicated that for nonroutine tasks (such as SPT in this study), task conflict increases team members' ability to scrutinize task issues and intensifies their knowledge-and information-processing ability to achieve superior performance. Nevertheless, this study advances our understanding that even in nonroutine task situations with higher levels of task conflict, members' mutual knowledge cognitive capabilities (i.e., TMS) may still be consumed by dealing with the conflict situation rather than processing task-relevant information and knowledge. We contribute to existing SPT and TMS research by suggesting that task conflict cannot be ignored while teams may hide conflicting tasks among members.

Finally, the results show that shared temporal cognitions enhance the influences of a team's TMS on SPT performance. Specifically, with higher levels of temporal consistency, TMS can help team members mutually accommodate their time-related actions (i.e., different actions taken due to different time perceptions of task duration and deadline) and effectively coordinate the timing of SPT knowledge flow among members to streamline the knowledge process, thereby reducing the collaborative decisional efforts of SPT. In addition, because teams operate with similar time-based perceptions, they are able to build collective knowledge maps by understanding when complementary professional SPT knowledge is needed when making a complex group decision. This enables teams to reduce information and knowledge overload and to amplify their cognitive processing ability to deliver better-quality tailored decisions. In modern organization and team management, the time-based characteristic is a critical task-relevant attribute (Mohammed and Nadkarni, 2014; Standifer et al., 2015; Santos et al., 2016). The findings of this study increase our understanding of the importance of temporally compatible views and behaviors among members when preparing and performing tasks that are dynamic and nonroutine in nature (in this study, SPT). Moreover, the individuals who compose a software team often have diverse temporally oriented views. This study contributes to the existing software project management literature by providing promising empirical findings to demonstrate that a time-based consensus is a critical contextual factor because it enhances software teams' knowledge-based cognitive mechanisms for SPT performance.

6.2. Practical implications

According to the results, TMS is shown to be beneficial to SPT performance, i.e., by streamlining the collaborative tailoring process and assuring the quality of tailoring decisions. Hence, effectively fostering software teams' TMS can lead to higher levels of SPT performance. To cultivate TMS, several treatments are provided in this study. The first treatment, i.e., assigning some members who have SPT experience to a team or retaining the same members on a team (Hsu et al., 2012), can increasingly improve the knowledge map (Chen et al., 2013) among the members. The second treatment, i.e., enhancing member interactions via joint decision making or increasing proximity, can foster nonjudgmental SPT environments in which members can freely share their opinions and experiences, including previously encountered difficulties or failures of process tailoring. The third treatment to facilitate TMS refers to the use of information technologies. For example, Cao and Ali (2018) and Lee et al. (2014) showed that access to social media technology can influence TMS by promoting efficient knowledge management in teams because facilitating the flow of information is critical to the transactive processes and structures underlying TMS.

The findings of this study revealed that task conflict acts as a negative moderator of the influences of TMS on SPT effectiveness and efficiency. It is nearly impossible for a team to have no task conflicts while performing SPT. Because task conflict is inevitable in SPT, this study suggests that managers, team leaders and members should learn how to perform effective team conflict management and mitigate the risk of turning task conflict into relationship conflict. A treatment is suggested as follows. Training is relatively important to foster the use of a cooperative approach in conducting SPT, and this is especially true when a team demonstrates poor conflict management skills (Desivilya et al., 2010). According to Tjosvold's (1998) experiments, a cooperative approach to conflict encourages team members to express their views directly and to accurately consider each other's perspective. That report and a subsequent study (Tjosvold et al., 2005) show that cooperative conflict helps teams understand each other and the opposing positions and develop more integrated, high-quality solutions to problems.

Finally, our work highlights that STC amplifies the effects of TMS-SPT effectiveness and TMS efficiency. In this regard, we suggest that team mangers should establish *temporal leadership* (Mohammed and Nadkarni, 2011; Santos et al., 2016), meaning that team leaders need to schedule, harmonize and coordinate activities and allocate time-related resources to reach a time-based consensus on tasks. Specifically, during SPT, team leaders should provide members with clear temporal guidelines and information, such as reminding them of internal and external deadlines of contextual tasks to avoid possible bullwhip effects and synchronizing the members' pacing style to coordinate rescheduled and newly composed tasks with different owners. Teamwork is highly influenced by workers' different personalities, and leaders can manage members with corresponding time-based managerial means. For example, proactive members with a more internal locus of control should be given moderate autonomy to arrange and perform SPT tasks on the premise that the tasks can be completed on time. For passive members who tend to have a more external locus of control, team leaders should show coercive leadership (Landa and Tyson, 2017), promptly remind them of temporal requirements and check their work progress more intensively. By doing so, the likelihood of temporal barriers can be diminished and the utility of temporal leadership can be exerted.

7. Conclusion and future research

This paper presented an investigation based on transactive memory systems (TMS) theory to develop a research model exploring how teams' TMS affects SPT performance with task conflict and shared temporal cognitions (STC) acting as moderators. The model and investigation results demonstrated that TMS overall exerts a positive impact on SPT performance giving the conflicting nature of SPT. In particular, task conflict is found to reduce the effect of TMS on SPT performance, whereas shared temporal cognitions amplify the influence of TMS-SPT performance. The theoretical and practical implications of the findings are also discussed to highlight the contribution of this study and guide software project teams in effectively conducting SPT.

Similar to all research, this study has some limitations that require further investigation and research. First, because our samples were collected from Taiwanese firms, the findings of this study might not be generalizable to all situations. Future studies could be undertaken in other regions or countries to further examine the proposed model and compare the results with ours. Second, this study primarily focused on teams and projects that are transient in nature and utilized cross-sectional data in the investigation. Therefore, cause-and-effect relationships might not be inferred from the results of the current study. In this regard, future research could conduct a longitudinal study to further identify the relationships among these variables as they develop over time. Third, regarding the data collection, the number of teams in the participating organizations and the number of responding participants per team are unequally distributed (See Table 2). Although this issue did not cause significant validity threats in this study, the compositions of the sample may skew the results. Therefore, we suggest that future research using a similar survey situation could also check the data to prevent this potential internal validity threat issue.

Fourth, in this study, all research constructs were operationalized at the same level, i.e., the team level. Nevertheless, the existing literature has indicated that an organization's demographic composition influences team work processes and outcomes (Chatman et al., 1998; Bezrukova et al., 2012; Guillaume et al., 2015). Correspondingly, this study suggests that follow-up research can employ multilevel analysis to explore and investigate how organizational-level factors such as culture (Lee et al., 2016; 2017), climate (Lee and Chen, 2019b; Kuenzi and Schminke, 2009) or leadership (Mohammed and Nadkarni, 2011; Guhr et al., 2018) influence software teams' operational mechanisms in conducting SPT. Finally, SPT is necessary in contemporary software development environments, such as sequential or agile development approaches. As SPT is not further distinguished into the sequential and agile development approaches in this study, future research may extend this study by investigating and examining whether there is a significant difference between these two development environments. By doing so, understanding of the SPT phenomenon can be further expanded.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jss.2020.110545.

Appendix. Questionnaire items

Construct	Items	Source
Transactive memory systems (TMS)	(TMS1) Our team members as task owners have specialized knowledge of their tasks. (TMS2) Our team members are comfortable accepting procedural suggestions from other task owners. (TMS3) Our team members trust that other members' knowledge about the tasks to be tailored and the affected tasks is credible. (TMS4) Our team members are confident in relying on the information that other team members bring to the discussion of SPT tasks. (TMS5) Our team members know each other and have the ability to perform software process tailoring tasks together in a well-coordinated fashion. (TMS6) Our team members have the capability to respond to the software process tailoring task-related problems smoothly and efficiently.	Choi et al. (2010)
Effectiveness of SPT (EE)	(EE1) This tailoring decision is based on the best available information for a software project. (EE2) This tailoring decision is made based on the valid assumptions of a project. (EE3) This tailoring decision helps the project achieve its objectives. (EE4) This tailoring decision makes sense in light of the project's current resource situation. (EE5) This tailoring decision is consistent with the strategy and context of integrated processes and product development.	Xu and Ramesh (2008); Dooley and Fryxell (1999); Slaughter et al. (2006)
Efficiency of SPT (EY)	(EY1) We accomplished SPT tasks in less time than expected. (EY2) We accomplished SPT tasks with lower effort than expected.	Xu and Ramesh (2008)
Task conflict (TC)	(TC1) Team members often disagree about the change or adjustment of the task or process for the goals in the SPT context. (TC2) Team members have different goals or considerations in the SPT context. (TC3) Team members have different ideas about the content of the work to be altered in the SPT context.	Liang et al. (2010)
Shared temporal cognitions (STC)	(STC1) In the SPT context, team members have the same opinion about meeting project deadlines. (STC2) When performing tailoring task, we have similar thoughts about the best way to use our time. (STC3) When the team performs SPT tasks, we agree on how to reallocate the remaining time available for the project. (STC4) Team members have similar ideas about the time it takes to perform each project task.	Gevers et al. (2006)

CRediT authorship contribution statement

Jung-Chieh Lee: Conceptualization, Methodology, Data curation, Writing - original draft, Visualization, Investigation, Writing - review & editing. **Yih-Tsyr Wang:** Conceptualization, Methodology, Visualization, Investigation. **Chung-Yang Chen:** Conceptualization, Methodology, Data curation, Writing - original draft, Visualization, Investigation, Supervision, Writing - review & editing.

References

Acikgoz, A., Gunsel, A., 2016. Individual creativity and team climate in software development projects: the mediating role of team decision processes. Creativity Innovat. Manag. 25 (4), 445–463.
Ahn, Y.W., Ahn, H.J., Park, S.J., 2003. Knowledge and case-based reasoning for customization of software processes -a hybrid approach. Int. J. Softw. Eng. Know. Eng. 13 (3), 293–312.
Alegria, J.A., Bastarrica, M.C., Quispe, A., Ochoa, S.F., 2014. MDE-based process tailoring strategy. J. Softw. 26 (4), 386–403.
Alipour, K.K., Mohammed, S., Martinez, P.N., 2017. Incorporating temporality into implicit leadership and followership theories: exploring inconsistencies between time-based expectations and actual behaviors. Leadersh. Q. 28 (2), 300–316.
Argote, L., Hora, M., 2017. Organizational learning and management of technology. Prod. Oper. Manag. 26 (4), 579–590.
Bass, J.M., 2016. Artefacts and agile method tailoring in large-scale offshore software development programmes. Inf. Softw. Technol. 75 (75), 1–16.
Bezrukova, K., Thatcher, S.M.B., Jehn, K.A., Spell, C.S., 2012. The effects of alignments: examining group faultlines, organizational cultures, and performance. J. Appl. Psychol. 97 (1), 77–92.
Campanelli, A.S., Camilo, R.D., Parreiras, F.S., 2018. The impact of tailoring criteria on agile practices adoption: a survey with novice agile practitioners in Brazil. J. Syst. Softw. 137, 366–379.
Cao, X., Ali, A., 2018. Enhancing team creative performance through social media and transactive memory system. Int. J. Inf. Manage. 39, 69–79.
Chatman, J.A., Polzer, J.T., Barsade, S.G., Neale, M.A., 1998. Being different yet feeling similar: the influence of demographic composition and organizational culture on work processes and outcomes. Adm. Sci. Q. 43 (4), 749–780.
Chen, X., Li, X., Clark, J.G., Dietrich, G.B., 2013. Knowledge sharing in open source software project teams: a transactive memory system perspective. Int. J. Inf. Manage. 33 (3), 553–563.
Choi, S.Y., Lee, H., Yoo, Y., 2010. The impact of information technology and transactive memory systems on knowledge sharing, application, and team performance: a field study. MIS Q. 34 (4), 855–870.
Chou, S., Chen, J.J., 2000. Process program change control in a process environment. Softw. - Pract. Experience 30 (3), 175–197.
Clarke, P., O Connor, R.V., Leavy, B., Yilmaz, M., 2015. Exploring the relationship between software process adaptive capability and organisational performance. IEEE Trans. Softw. Eng. 41 (12), 1169–1183.
Conboy, K., Fitzgerald, B., 2010. Method and developer characteristics for effective agile method tailoring: a study of XP expert opinion. ACM Trans. Softw. Eng. Methodol. 20 (1), 1–30.
Crawford, B., Soto, R., de la Barra, C.L., Crawford, K., Olguín, E., 2014. Agile software teams can use conflict to create a better products. Commun. Comput. Inf. Sci. 24–29.
De Clercq, D., Mohammad Rahman, Z., Belausteguigoitia, I., 2015. Task conflict and employee creativity: the critical roles of learning orientation and goal congruence. Hum. Resour. Manage 56 (1), 93–109.
De Dreu, C.K.W., 2006. When too little or too much hurts: evidence for a curvilinear relationship between task conflict and innovation in teams. J. Manage. 32 (1), 83–107. doi:10.1177/0149206305277795.
De Dreu, C.K.W., Weingart, L.R., 2003. Task versus relationship conflict, team effectiveness, and team member satisfaction: a meta-analysis. J. Appl. Psychol. 88, 741–749.
Desivilya, H.S., Somech, A., Lidgoster, H., 2010. Innovation and conflict management in work teams: the effects of team identification and task and relationship conflict. Negotiat. Confl. Manag. Res. 3 (1), 28–48.
De Wit, F.R.C., Greer, L.L., Jehn, K.A., 2012. The paradox of intragroup conflict: a meta-analysis. J. Appl. Psychol. 97 (2), 360–390.
Donzelli, P., 2003. Tailoring the software maintenance process to better support complex systems evolution projects. J. Softw. Mainten. Evolut. 15 (1), 27–40.
Dooley, R.S., Fryxell, G.E., 1999. Attaining decision quality and commitment from dissent: The moderating effects of loyalty and competence in strategic decision–making teams. Acad. Manage. J. 2 (4), 389–402.
Ebert, C., Man, J.D., 2008. Effectively utilizing project, product and process knowledge. Inf. Softw. Technol. 50 (6), 579–594.
Ellwart, T., Happ, C., Gurtner, A., Rack, O., 2015. Managing information overload in virtual teams: effects of a structured online team adaptation on cognition and performance. Eur. J. Work Org. Psychol. 24 (5), 311–317.
Faraj, S., Sproull, L., 2000. Coordinating expertise in software development teams. Manage Sci 46 (12), 1554–1568.
Fitzgerald, B., Russo, N.L., O'Kane, T., 2003. Software development method tailoring at Motorola. Commun. ACM 46 (4), 64–70.
Foo, M.-D., 2011. Teams developing business ideas: how member characteristics and conflict affect member-rated team effectiveness. Small Bus. Econ. 36 (1), 33–46.
Gavetti, G., Greve, H.R., Levinthal, D.A., Ocasio, W., 2012. The behavioral theory of the firm: assessment and prospects. Acad. Manag. Ann. 6 (1), 1–40.
Gevers, J.M.P., Rutte, C.G., van Eerde, W., 2006. Meeting deadlines in work groups: implicit and explicit mechanisms. Appl. Psychol. 55, 52–72.
Gevers, J.M.P., van Eerde, W., Rutte, C.G., 2009. Team self-regulation and meeting deadlines in project teams: antecedents and effects of temporal consensus. Eur. J. Work Org. Psychol. 18 (3), 295–321.
Gevers, J.M.P., Peeters, A.G.M., 2009. A pleasure working together? the effects of dissimilarity in team member conscientiousness on team temporal processes and individual satisfaction. J. Org. Behav. 30 (3), 379–400.
Gino, F., Argote, L., Miron-Spektor, E., Todorova, G., 2010. First, get your feet wet: the effects of learning from direct and indirect experience on team creativity. Org. Behav. Hum. Decis. Process. 111 (2), 102–115.
Ginsberg, M.P., Quinn, L.H., 1995. Process tailoring and the software capability maturity model. Technical Report CMU/SEI-94-TR-024. Software Engineering Institute.
Guhr, N., Lebek, B., Breitner, M.H., 2018. The impact of leadership on employees' intended information security behaviour: an examination of the full-range leadership theory. Inf. Syst. J.. doi:10.1111/isj.12202.
Guillaume, Y.R.F., Dawson, J.F., Otaye-Ebede, L., Woods, S.A., West, M.A., 2015. Harnessing demographic differences in organizations: what moderates the effects of workplace diversity? J. Org. Behav. 38 (2), 276–303.
Hair, J.F., Hult, G.T.M., Ringle, C., Sarstedt, M., 2013. A Primer On Partial Least Squares Structural Equation Modeling (PLS-SEM). SAGE Publications.
Hair, J.F., Sarstedt, M., Ringle, C.M., 2019. Rethinking some of the rethinking of partial least squares. Eur. J. Mark. 53 (4), 566–584.
Henseler, J., Hubona, G., Ray, P.A., 2016. Using PLS path modeling in new technology research: updated guidelines. Ind. Manag. Data Syst. 116 (1), 2–20.
Hsu, J.S., Hung, Y.W., Chen, Y., Huang, H., 2013. Antecedents and consequences of user coproduction in information system development projects. Project Manag. J. 44 (2), 67–87.
Hsu, J.S.C., Shih, S.P., Chiang, J.C., Liu, J.Y.C., 2012. The impact of transactive memory systems on IS development teams' coordination, communication, and performance. Int. J. Project Manag. 30 (3), 329–340.
Huang, C.C., Chen, P.K., 2018. Exploring the antecedents and consequences of the transactive memory system: an empirical analysis. J. Know. Manag. 22 (1), 92–118.
Humphrey, S.E., Aime, F., Cushenbery, L., Hill, A.D., Fairchild, J., 2017. Team conflict dynamics: implications of a dyadic view of conflict for team performance. Org. Behav. Hum. Decis. Process. 142, 58–70.
James, L.R., Demaree, R.G., Wolf, G., 1984. Estimating within-group interrater reliability with and without response bias. J. Appl. Psychol. 69 (1), 85–98.
Jehn, K.A., 1995. A multimethod examination of the benefits and detriments of intragroup conflict. Adm. Sci. Q. 40 (2), 256.
Jehn, K.A., 1997. A qualitative analysis of conflict types and dimensions in organizational groups. Adm. Sci. Q. 42 (3), 530–557.
Jehn, K.A., Mannix, E.A., 2001. The dynamic nature of conflict: a longitudinal study of intragroup conflict and group performance. Acad. Manag. J. 44 (2), 238–251.
Jiacheng, W., Lu, L., Francesco, C.A., 2010. A cognitive model of intraorganizational knowledge-sharing motivations in the view of cross-culture. Int. J. Inf. Manag. 30 (3), 220–230.
Jiang, J.Y., Zhang, X., Tjosvold, D., 2012. Emotion regulation as a boundary condition of the relationship between team conflict and performance: a multi-level examination. J. Org. Behav. 34 (5), 714–734.
Karn, J.S., Cowling, A.J., 2008. Measuring the effect of conflict on software engineering teams. Behav. Res. Methods 40 (2), 582–589.
Kawalek, P., Leonard, J., 1996. Evolutionary software development to support organizational and business process change: a case study account. J. Inf. Technol. 11 (3), 185–198.
Kees, J., 2010. Temporal framing in health advertising: the role of risk and future orientation. J. Curr. Iss. Res. Adver. 32 (1), 33–46.
Kock, N., 2015. Common method bias in PLS-SEM: a full collinearity assessment approach. Int. J. e-Collaborat. 11 (4), 1–10.
Kotlar, J., De Massis, A., Wright, M., Frattini, F., 2018. Organizational goals: antecedents, formation processes and implications for firm behavior and performance. Int. J. Manag. Rev. 20, S3–S18.
Kuenzi, M., Schminke, M., 2009. Assembling fragments into a lens: a review, critique, and proposed research agenda for the organizational work climate literature. J. Manag. 35 (3), 634–717.
Laker, L.F., Froehle, C.M., Windeler, J.B., Lindsell, C.J., 2017. Quality and efficiency of the clinical decision-making process: information overload and emphasis framing. Prod. Oper. Manag.. doi:10.1111/poms.12777.
Landa, D., Tyson, S.A., 2017. Coercive leadership. Am. J. Pol. Sci. 61 (3), 559–574.
Lee, J., Bachrach, D.G., Lewis, K., 2014. Social network ties, transactive memory, and performance in groups. Org. Sci. 25 (3), 951–967.
Lee, J.C., Chen, C.Y., 2019a. Investigating the environmental antecedents of organizations' intention to adopt agile software development. J. Enterp. Inf. Manag. 32 (5), 869–886.
Lee, J.C., Chen, C.Y., 2019b. Exploring the determinants of software process improvement success: a dynamic capability view. Inf. Dev. 35 (1), 6–20.
Lee, J.C., Chen, C.Y., Shiue, Y.C., 2017. The moderating effects of organisational culture on the relationship between absorptive capacity and software process improvement success. Inf. Technol. People 30 (1), 47–70.

Lee, J.C., Hsu, W.C., Chen, C.Y., 2018. Impact of absorptive capability on software process improvement and firm performance. Inf. Technol. Manag. 19, 21–35.
Lee, J.C., Shiue, Y.C., Chen, C.Y., 2016. Examining the impacts of organizational culture and top management support of knowledge sharing on the success of software process improvement. Comput. Hum. Behav. 54, 462–474.
Li, Y.H., Huang, J.W., 2013. Exploitative and exploratory learning in transactive memory systems and project performance. Inf. Manag. 50 (6), 304–313.
Liang, T.P., Jiang, J., Klein, G.S., Liu, Y.C., 2010. Software quality as influenced by informational diversity, task conflict, and learning in project teams. IEEE Trans. Eng. Manag. 57 (3), 477–487.
Liberman, N., Trope, Y., 1998. The role of feasibility and desirability considerations in near and distant future decisions: a test of temporal construal theory. J. Pers. Soc. Psychol. 75 (1), 5–18.
Lin, T., Hsu, J.S., Cheng, K., Wu, S., 2012. Understanding the role of behavioural integration in ISD teams: an extension of transactive memory systems concept. Inf. Syst. J. 22 (3), 211–234.
Lewis, K., Herndon, B., 2011. Transactive memory systems: current issues and future research directions. Org. Sci. 22 (5), 1254–1265.
Lycett, M., Macredie, R.D., Patel, C., Paul, R.J., 2003. Migrating agile methods to standardized development practice. IEEE Comput. 36 (6), 79–85.
Mohammed, S., Nadkarni, S., 2011. Time-based individual differences and team performance: the moderating role of temporal leadership. Acad. Manag. J. 54, 489–508.
Mohammed, S., Nadkarni, S., 2014. Are we all on the same temporal page? the moderating effects of temporal team cognition on the polychronicity diversity–team performance relationship. J. Appl. Psychol. 99 (3), 404–422.
Nevo, D., Benbasat, I., Wand, Y., 2012. Understanding technology support for organizational transactive memory: requirements, application, and customization. J. Manag. Inf. Syst. 28 (4), 69–98.
Paese, P.W., 1995. Effects of framing on actual time allocation decisions. Org. Behav. Hum. Decis. Process. 61 (1), 67–76.
Park, S.H., Bae, D.H., 2013. Tailoring a large-sized software process using process slicing and case-based reasoning technique. IET Softw. 7 (1), 47–55.
Park, S.H., Bae, D.H., 2011. An approach to analyzing the software process change impact using process slicing and simulation. J. Syst. Softw. 84 (4), 528–543.
Park, S.H., Na, H., Park, S., Sugumaran, V., 2006. A semi-automated filtering technique for software process tailoring using neural network. Expert Syst. Appl. 30 (2), 179–189.
Peltokorpi, V., Hasu, M., 2016. Transactive memory systems in research team innovation: a moderated mediation analysis. J. Eng. Technol. Manag. 39, 1–12.
Podsakoff, P.M., MacKenzie, S.B., Lee, L.Y., Podsakoff, N.P., 2003. Common method biases in behavioral research: a critical review of the literature and recommended remedies. J. Appl. Psychol. 88 (5), 879–903.
Puck, J., Pregernig, U., 2014. The effect of task conflict and cooperation on performance of teams: are the results similar for different task types? Eur. Manag. J. 32 (6), 870–878.
Ren, Y., Argote, L., 2011. Transactive memory systems 1985–2010: an integrative framework of key dimensions, antecedents, and consequences. Acad. Manag. Ann. 5 (1), 189–229.
Ringle, C.M., Wende, S., and Becker, J.M. (2015). SmartPLS 3. Boenningstedt: SmartPLS GmBH, http://www.smartpls.com.
Ringle, C.M., Sarstedt, M., Mitchell, R., Gudergan, S.P., 2019. “Partial least squares structural equation modeling in HRM research. Int. J. Hum. Resour. Manag. Forthcoming.
Rönkkö, M., Mcintosh, C.N., Antonakis, J., Edwards, J.R., 2016. Partial least squares path modeling: time for some serious second thoughts. J. Oper. Manag. 47 (1), 9–27.
Romero, H.L., Dijkman, R.M., Grefen, P.W.P.J., van Weele, A.J., de Jong, A., 2015. Measures of process harmonization. Inf. Softw. Technol. 63, 31–43.
Ryan, S., O'Connor, R.V., 2013. Acquiring and sharing tacit knowledge in software development teams: an empirical study. Inf. Softw. Technol. 55 (9), 1614–1624.
Santos, C.M., Passos, A.M., Uitdewilligen, S., Nübold, A., 2016. Shared temporal cognitions as substitute for temporal leadership: an analysis of their effects on temporal conflict and team performance. Leadersh Q. 27 (4), 574–587.
Sawyer, S., 2001. Effects of intra-group conflict on packaged software development team performance. Inf. Syst. J. 11 (2), 155–178.
Schneider, B., Hanges, P.J., Smith, D.B., Salvaggio, A.N., 2003. Which comes first: employee attitudes or organizational financial and market performance? J. Appl. Psychol. 88 (5), 836–851.
Shiau, W., Sarstedt, M., Hair, J.F., 2019. Internet research using partial least squares structural equation modeling (PLS-SEM). Internet Res. 29 (3), 398–406.
Simeonova, B., 2017. Transactive memory systems and web 2.0 in knowledge sharing: a conceptual model based on activity theory and critical realism. Inf. Syst. J. 28 (4), 592–611.
Simons, T.L., Peterson, R.S., 2000. Task conflict and relationship conflict in top management teams: the pivotal role of intragroup trust. J. Appl. Psychol. 85 (1), 102–111.
Slaughter, L., Ramesh, P.-H., Baskerville, 2006. Aligning software processes with strategy. MIS Q. 30 (4), 891–918.
Speier, C., Valacich, J.S., Vessey, I., 1999. The influence of task interruption on individual decision making: an information overload perspective. Decis. Sci. 30 (2), 337–360.
Standifer, R.L., Raes, A.M.L., Peus, C., Passos, A.M., Santos, C.M., Weisweiler, S., 2015. Time in teams: cognitions, conflict and team satisfaction. J. Manager. Psychol. 30 (6), 692–708.
Tjosvold, D., 1998. The cooperative and competitive goal approach to conflict: accomplishments and challenges. Appl. Psychol. 47, 285–342.
Tjosvold, D., Poon, M., Yu, Z., 2005. Team effectiveness in china: cooperative conflict for relationship building. Hum. Relat. 58 (3), 341–367.
Tripp, J.F., Armstrong, D.J., 2018. Agile methodologies: organizational adoption motives, tailoring, and performance. J. Comput. Inf. Syst. 58 (2), 170–179.
Trope, Y., Liberman, N., 2003. Temporal construal. Psychol. Rev. 110 (3), 403–421.
Uitdewilligen, S., Waller, M.J., Pitariu, A.H., 2013. Mental model updating and team adaptation. Small Group Res. 44, 127–158.
Wang, Y., Huang, Q., Davison, R.M., Yang, F., 2018. Effect of transactive memory systems on team performance mediated by knowledge transfer. Int. J. Inf. Manag. 41, 65–79.
Wegner, D.M., Erber, R., Raymond, P., 1991. Transactive memory in close relationships. J. Pers. Soc. Psychol. 61, 923–929.
Whelan, E., Teigland, R., 2013. Transactive memory systems as a collective filter for mitigating information overload in digitally enabled organizational groups. Inf. Org. 23 (3), 177–197.
Xiang, C., Lu, Y., Gupta, S., 2013. Knowledge sharing in information system development teams: examining the impact of shared mental model from a social capital theory perspective. Behav. Inf. Technol. 32 (10), 1024–1040.
Xu, P., Ramesh, B., 2007. Software process tailoring: an empirical investigation. J. Manag. Inf. Syst. 24 (2), 293–328.
Xu, P., Ramesh, B., 2008. Impact of knowledge support on the performance of software process tailoring. J. Manag. Inf. Syst. 25 (3), 277–314.

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