Autonomous, but Interdependent: The Roles of Initiated and Received Task Interdependence in Distributed Team Coordination

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Abstract

Distributed team arrangements are becoming "the new normal". The present study considers the evolution of electronic commerce into an area where operational interaction and coordination of work occurs, where previously only commerce occurred. As more teams are moving online, the need to understand the conditions supporting team coordination is becoming more and more prevalent. By examining the moderating roles of initiated and received task interdependence on the relationship between perceptions of self-management and coordination in distributed teams, we aim to advance research in the area of e-commerce and benefit distributed teams in current and future practice. Results based on a survey from 101 professionals working in distributed teams indicate that the level of team self-management is positively related to perceived coordination when the level of initiated task interdependence within a team is high, as well as when the level of received task interdependence is low. These findings further indicate that initiated and received team task interdependence represent difference team coupling structures that can enable or hinder team coordination. Theoretical and practical implications for the boundary conditions to sustain coordination in self-managing teams are discussed.

Keywords: Autonomous teams, distributed teams, task interdependence, electronic communication, coordination

Introduction

Almost three decades ago, the function of electronic commerce (e-commerce) shifted from almost exclusively focusing on commerce, to include online operational work processes as well [82]. Digital technology is therefore not only a driver of e-commerce [82] – but also encompasses work processes and interactions [e.g., 81]. The importance of understanding what supports these digital work processes appears to be more prevalent than ever before, as the COVID-19 pandemic has forced professionals to work in distributed teams. Distributed teams are defined as teams that consist of two or more members, who collaborate to achieve shared goals while one or more team members are distributed in different locations and their communication and coordination predominantly rely on electronics [28]. Digitalization of teams changes how employees interact with others in their field, their teams, and their organization [4]. Such forms of work are associated with beneficial outcomes such as increased productivity and superior access to global markets [9; 25]. However, digital work teams also present employees with more ambiguous climates and less accessibility to information [49]. Challenges of digital teams include reduced communication quality and coordination [9], resulting in more interpersonal and task conflict, as well as reduced performance and work engagement [29]. Despite its importance, many workers, teams and organisations are not prepared for the distributed work arrangement and have little time to adapt for better team functioning. Pressing questions are being raised regarding how to ensure team functioning in a distributed setting.

March and Simon [48] stressed that as long as there is more than one person in the organization, the degree of coordination among workers would largely influence the individual and team performance and subsequently organizational effectiveness. Team coordination, defined as “the managing of dependencies between activities” [47], is central to management *[*60; 76], information systems (IS) and software engineering [6; 15; 72], and interdisciplinary

fields like e-commerce [11; 17; 83]. Drawing upon this interdisciplinary approach, according to coordination theory [47], coordination involves managing task progress through collective contributions, in which one's inputs rely on the outputs of others to realize shared goals [47; 72]. As such, team coordination is largely reliant on team members' interactions and interdependence structure [e.g., 3; 22; 62; 73]. The fluid structure of task interdependence, which refers to the degree to which interaction among team members are required to complete tasks [14; 26], combined with the lack of face-to-face interaction have been recognized as challenging for distributed teams [56].

Autonomous, or self-managing, distributed teams have gained traction as a result of the growing popularity of the agile organizational mindset, representing flexibility, involvement, and self-management and are prevalent in knowledge-intensive industries such as the information systems and software development industries [22; 63]. The degree to which distributed teams can collectively self-manage interdependent tasks is said to be crucial to foster team coordination, effectiveness, and performance [51]. There is a general assumption that members of high self-managing teams are in better control of their own task flow, which would lead to better team coordination. However, in distributed settings, this assumption has been challenged as self-managing team members need to balance autonomy and interdependence, remaining aware of the individual tasks of each team member with little to no face-to-face interaction to coordinate tasks [32]. In addition, the relationships between team autonomy and work outcomes are deemed conditional [e.g., 34; 35; 41; 71]. In other words, team autonomy is necessary but not sufficient in understanding team functioning. In particular for distributed teams, the fluid contextual environment where the teams are dependent on electronic communication to coordinate their work, the teams' coupling structure, which refers to team members' interaction structure [57] is weakened. For distributed team members, the idea of balancing autonomy and interdependence through digital means can impose conflicting

conditions for team members to coordinate. Autonomy can undermine task interdependence, while task interdependence can constrict autonomy [28; 35; 42]. This tension between autonomy and interdependence is understudied in the current literature and particularly in the field of IS development teams, where both autonomy and interdependence are essential to team functioning [35].

There are two types of task interdependence, namely initiated and received task interdependence. The former refers to the extent to which work is flowing from a particular job to one or more other jobs, while the latter is concerned with the extent to which a particular job is affected by the workflow from other jobs [36; 53]. Despite their conceptual differences, only a few studies have investigated how these different interdependence structures may influence team functioning [19; 39; 65; 74]. Extending this line of inquiry, we base our reasoning on organizational information theory and the notions of loosely coupled systems and collective sensemaking [57; 77; 78] and argue that in autonomous distributed teams, whether individual team members see the autonomy in the teams to enhance or limit their coordination may depend on their perceptions of their team interdependencies impacting their work. More specifically, it is likely that autonomy combined with initiated task interdependence can serve as an enhancer for team reflexivity [35], while autonomy combined with received task interdependence can constrict team autonomy.

By investigating this, our intended contributions are three-fold. First, much organizational research has focused on physical location [80] of employees, retailers, and offices, but as e-commerce extends its reach past online commerce and fully into distributed teams and entirely remote offices, research on how to utilize these environments is imperative. We aim to provide timely insights into what successful distributed teams may look like and how they can be maintained. Second, we aim to contribute to the behavioural side of the IS research field [2], going beyond the information systems in use, to examining the contextual conditions of

distributed employees using such systems. Third, we aim to contribute to organizational information theory by looking into the moderating roles of interdependence structures for autonomous distributed team to coordinate and thereby expand our understanding of the boundary conditions. In particular, our findings will contribute to better understand the tension between autonomy and interdependence, which has been a great challenge for IS development teams [35]. We proposed and tested that the two types of task interdependence, i.e., initiated versus received task interdependence, can serve as different boundary structures for self-managing distributed teams to coordinate.

Theory and hypotheses

Coordination in self-managing or autonomous distributed teams

Self-management, or autonomy (the terms are often used interchangeably), may be conceptualized as a feature of job design that represents the extent to which the job provides employees with discretion and control in deciding how to accomplish tasks [63]. In a team setting, an autonomous team implies that the team is set up and designed such that the team members may themselves take control of task accomplishment [63]. Autonomous distributed teams have also received increasing research attention in recent years, particularly within information systems and software development, where agile development practices place a strong focus on self-management and autonomous teams, both within research and practice [35; 51; 72; 73].

The introduction of autonomous teams stemmed from meeting challenges such as increased international competition, a changing workforce, and rapidly changing environments [46; 63] – challenges that in many ways are just as prevalent today in light of digital transformation. In autonomous distributed teams, team members are expected to share leadership [24; 51] and to

coordinate work activities within their team, such as scheduling work activities, assigning work to fellow team members, and monitoring their own performance [24; 63].

With outsourcing and off-shore development being popular digital business models, distributed teams have gained massive popularity [24]. The popularity of distributed teams can be attributed to organizational advantages such as flexibility, cost-effectiveness, and the relative ease by which they can be set up [24]. An early longitudinal study within e-commerce [69] showed that individuals may choose distributed work arrangements due to similar reasons. At the same time, their respondents reported motivations to stay in the office, such as the need for supervision, as well as work-related and social interaction with colleagues [77]. These findings remain relevant to e-commerce today, because despite the advantages of distributed teams, their reliance on computer-mediated communication places a greater demand on team members' self-management skills [39] and ability to recognize the level of task interdependence within the team [27]. Moreover, computer-mediated communication reduces team members' abilities to control communication processes, norms, and behaviours [43], which in turn may be associated with increased coordination problems [31].

Coordination is widely understood as the management of dependencies between activities [47]. A dependency occurs when the progress of something (be it a person, a task, an artefact, or a piece of information) relies on the output of something else. Dependencies are managed by the use of coordination mechanisms such as team meetings, work practices, and in the distributed setting, electronic communication tools [12; 47; 72]. As such, coordination is about the integration of organizational work under conditions of task interdependence and uncertainty [22]. Allowing distributed teams such autonomy and flexibility presumably have been attributed to better team coordination [3; 42; 63]. Yet, more recent research has pointed out that autonomy can be a double edge sword for team functioning [35; 41].

When considering the alleged benefits versus coordination challenges, there is a paradox inherent in autonomous distributed teams, which is often employed in information systems development teams [35]. As the level of self-management increases, so do the interdependence and coordination requirements among team members [42; 43]. The premise of autonomous teams is that team members may take advantage of the flexibility to adapt to task demands and to make decisions on how to coordinate their efforts. However, for distributed teams, due to the lack of face-to-face communication, the flexibility can potentially create a complex and more demanding task structure for each individual team member to coordinate [8]. Compared to co-located teams, such team constellations may require more aligned perceptions about the team's focal goals, as well as a mutual knowledge and understanding of team members' roles and tasks contributing to the overall team effort [12], which is found to be challenging to achieve in distributed teams [8]. Studies on coordination in large-scale IS development settings have supported these notions, for instance by demonstrating the role of informal meetings for knowledge sharing which are less likely to take place in distributed settings [52; 70].

As such, while autonomy can help team members take better charge of their workflow, autonomy may also make team coordination difficult [41; 51; 63]. More specifically, while the team may be self-managing, the autonomy of each individual team member can undermine their abilities and perceived needs to coordinate [35]. In addition, the more autonomous a team is, the more team members need to understand how to balance individual work [43], interdependencies with colleagues [42], as well as the larger organizational structures surrounding the team [51]. This increased understanding is needed because in distributed settings when team members are working remotely, they may not clearly observe each other's work roles in order to achieve timely coordination of their interdependent tasks.

Accordingly, members of autonomous distributed teams may experience the independence nested in self-management practices as limiting in regard to how they relate to other team members [43]. Specifically, research on the unintended consequences of self-management has suggested that, if improperly handled, high levels of team autonomy can lead to detrimental team outcomes such as increased task conflict as well as reduced interpersonal trust [40; 42]. A recent review of the self-managing teams literature also shows that autonomous teams may not always be effective, and that factors residing at the individual level (such as need for autonomy) and at the team level (such as task interdependence) may influence the effectiveness of autonomous teams [46]. We further expect that being distributed and thus reliant on electronic communication tools may present additional challenges for coordination in autonomous teams [31].

Indeed, working in a distributed team implies that there is a certain level of electronic dependence in the team coordination. Electronic dependence is defined as the reliance on computer-mediated communication tools and information systems among team members in order for them to coordinate with one another [23]. Advances in electronic communication tools allow team members to communicate swiftly and timely using e-mail, teleconferencing or collaborative software such as enterprise social media. On the one hand, electronic communication facilitates coordination in distributed teams by enabling team members to communicate across spatial locations, while on the other hand it may hinder distributed team coordination due to the inherent constraints such as reduced communication quality, misaligned temporality, and frequency of communication required among team members [8].

Along with quality, the frequency of communication among distributed team members may be different compared to co-located team members. In particular, team members who do not meet face-to-face often communicate less frequently [64]. High frequency and quality of communication among team members appear essential to enhance distributed team

coordination, not only for exchanging information essential to coordination, but also for strengthening team member interpersonal couplings, which refers to the pattern of mutual relations between team members [57]. In distributed settings, where some or all team members may not meet face-to-face on a regular basis, team members may lack mutual knowledge about each other's situations. Thus, their interpersonal coupling structure may be weaker, which may lead to lower levels of trust, commitment, and knowledge sharing [38], as well as increased communication problems [23]. A weaker coupling structure could increase the difficulty in achieving efficient team coordination. However, although distributed, team members are still likely to be interdependent in carrying out their tasks. This makes them more dependent on each other, which in turn makes the team intrapersonal connections and the coupling structure more important for achieving high-quality coordination [30]. Hence, we consider the level of autonomy to perhaps not necessarily help distributed team members to coordinate. Rather, the relationship between autonomy and coordination may be dependent on the teams' interaction structures. In our study, we particularly investigate the roles of task interdependence as proxies for their interaction structure.

The moderating roles of initiated and received task interdependence

Task interdependence is considered an important boundary structure to understand how autonomy influence team coordination [41]. In teamwork, dependencies arise between team members who need to rely on each other's output to progress with their work. Several operationalizations and conceptualizations of interdependence have been developed. These perspectives include structural versus behavioural views on interdependence [14], as well as distinct conceptualizations like workflow interdependencies [30], technological interdependence [3], and task and outcome interdependence [14]. Among the different types of interdependence, task interdependence, which refers to "the degree to which work is designed so that members depend upon one another for access to critical resources and create workflows

that require coordinated action" [14], has been noted as particularly influential for understanding how team members interact [3; 14; 37]. Specifically, task interdependence serves as an indicator of the team's coupling structure, because the more team members need each other's input to do their work, the more they are likely to interact [57].

There are two types of task interdependence, namely initiated and received task interdependence [36; 53; 74]. Initiated task interdependence refers to the extent to which work is flowing from a particular job to one or more other jobs. Received task interdependence, on the other hand, refers to the extent to which a particular job is affected by the workflow from other jobs [36; 53]. An individual may both initiate and receive work within the same team. Although all team members share the same overall objectives (i.e., the team's focal goal), each individual may often handle different portions of any particular task. As such, sometimes team members may perceive high levels of initiated task interdependence because they initiate the work of others, and at other times, they may depend on the completion of other team members' work and perceive higher levels of received task interdependence. Although the two types of task interdependence are related, they are conceptualized as unique task or job dimensions [36; 53] and should therefore be differentially related to perceptions of coordination. Such a distinction seems reasonable, considering how task interdependence is perceived within a team may have implications for how team members perceive their coordination. However, currently there are only a few empirical studies that have differentiated between the two forms of interdependence [19; 53; 74].

Initiated task interdependence encompasses a responsibility that the initiating team member feels toward other team members relying on his or her work [74]. The feeling of others being dependent on an individual can instil higher levels of self-efficacy [74]. In addition, it can also instil a felt responsibility to meet expectations from others [19]. This would be particularly important to buffer the independence in autonomous distributed teams when team interaction

can be marginalized. If the level of initiated task interdependence within a team is high, it could serve as a mechanism to tie team members more closely together [30], such that team members are likely to feel responsible for other members' workflows. As such, individuals initiating task interdependence are likely to feel motivated to, for instance, initiate more interactions and engage in more cooperative team behaviours to enable other team members who need their inputs to go about their work, to potentially reduce the ambiguity derived from the autonomy they have [41] to coordinate. We expect that when the level of initiated interdependence within the team is high, coordination is likely to be perceived as higher, as the individual team members aim to facilitate each other's work. Therefore, we hypothesize:

H1: *Initiated task interdependence positively moderates the positive relationship between team self-management and perceived coordination such that the relationship is significantly more positive when initiated interdependence is high compared to when it is low.*

In situations where a team member experiences received task interdependence, that is, perceives themselves to be dependent on another team member to accomplish his or her work, the motivation for coordination may be different from employees initiating interdependence [19; 74]. In his seminal work on initiated and received interdependence, Kiggundu [36] did not find the same positive motivational impact for received interdependence compared to initiated interdependence, such that received interdependence was negatively related to job involvement. In other words, team members with high received task interdependence become more passive doing their jobs. These findings imply that high levels of received interdependence may lead to less job involvement and less engagement in overviewing the teams' strategies and behaviours toward attaining the common goal [60]. Further, as non-traditional teams rely heavily on unplanned communication [38], it is likely that the isolated nature of distributed

teams further enables withdrawal of these teammates. As such, it would be less likely that team members with high received task interdependence would utilize the autonomy within their team to coordinate their work. This effect would be particularly important to understand when coordinating and sustaining distributed teams, whose reliance on information systems has been understudied in this facet. With that being said, we expect that the relationship between team self-management and perceived coordination would be less positive when individuals perceive the levels of received interdependence within the team as high compared to when it is low. Thus, we posit:

H2: *Received task interdependence negatively moderates the positive relationship between team self-management and perceived coordination such that the relationship is significantly positive when received interdependence is low compared to when it is high.*

Insert Figure 1 about here

Data and Methodology

Sample

Our sample consisted of 101 individuals in 31 teams from three different Norwegian organizations. A survey was sent out to 471 employees from different work units in the three organizations in the spring of 2017, of which 110 individuals (23%) responded. However, nine of them did not have any other team members who had answered the survey and were thus removed. Among them, 61 participants were employees of the first organization, 18 belonged to the second and 22 belonged to the third organization. In terms of demographics, 67 (66.3%)

were male, and 34 (33.7%) were female. The average age was 41.3 years (s.d. = 9.6). The participants had a tenure with their current team of 2.8 (s.d. = 2.8). Most of the participants held a bachelor's degree (44.6%), followed by high school diploma (17.8%), master's degree (12.9%) and junior high school education (6.9%).

The number of team members per team included in the analyses ranged from two to six. On average, there were 3.3 team members per team included in the analyses, which is representative of the team sizes in these organizations. All teams were distributed and worked together across geographically dispersed locations. To facilitate communication, the teams relied on electronic communication tools (i.e., e-mail, teleconferencing, and collaborative software) [23] to various degrees. The majority of them (66.3%) said that they relied to a great extent (5/5) on e-mail for communication in their daily work, while 30.7% had a moderate (3/5) to high (4/5) level of reliance. A total of 34.7% and 31.7% of participants said a high degree (4/5) of their daily work routine involved using videoconferencing and collaborative software, respectively, for communication, followed by 23.8% and 27.7% to a great degree (5/5) and 23.8% and 23.8% to a moderate degree (3/5). Overall, they demonstrated a relatively high extent of electronic dependence in interacting with others at work.

Measures

All constructs were measured using 7-point scales, and all measures used in this study were adopted from previous research.

Self-management was measured using the three-item scale from the resistance to SMWTs measure [67]. These items have previously been used to measure resistance toward self-management by reversing the items. In the present study, we did not reverse the items, such that they reflect perceptions of the current degree of perceptions toward self-management within the team. A sample item is "Members of this team are eager to take on the responsibilities

traditionally reserved for management." In the original study [56], the reverse-items scale had a Cronbach's alpha (α) of .72. In the present study, the non-reversed items had a reliability of .90.

Initiated and received task interdependence were measured using two scales from Morgeson and Humphrey's Work Design Questionnaire [53]. Each scale consisted of three items. Sample items are "Others depend directly on my job" (initiated) and "My job cannot be done unless others do their work" (received). In our sample, the α's of initiated interdependence and received interdependence were .90 and .89, respectively, compared to .80 and .84, as obtained by Morgeson and Humphrey.

Coordination was measured with five items from Lewis' [44] Transactive Memory System Scale (α = .78). Sample items include "Our team worked together in a well-coordinated fashion" and "We accomplished the tasks smoothly and efficiently." In our sample, the scale had an α of .78.

Control variables. We controlled for demographic variables including age, gender and education, as these could potentially account for variance in work-related assessments [75]. Further, as individuals with longer tenure may have attained job-related knowledge about their organization and leaders [55], we controlled for team members' organizational tenure and tenure with their leaders, as well as managerial responsibilities, measured in true numbers. We also controlled for employment fraction and their electronic dependence. We measured electronic dependence using Gibson and Gibbs' [23] scale to capture the degree to which individuals were dependent on computer-mediated communication to stay in touch with their team members in their work. We asked participants to indicate from 1 (not at all) to 5 (to a large degree) their daily reliance on email, teleconferencing, and collaborative software. Finally, we controlled for virtual work system alignment using a scale modified from the High Performance Work Systems scale [21] and the degree of electronic dependence [23], rated from 1 (not at all)

to 5 (a great extent), to ensure the variance nested in the wider work structure would be taken into account.

Analytical procedures

Data aggregation. In our conceptual model, the predictor (self-management) and the two moderators (initiated and received task interdependence) reside at the team level, while the outcome variable resides at the individual level. We applied the referent-shift consensus model where individual team members are asked to assess multiple aspects of their team and their responses are then aggregated to the team level [10]. The referent-shift consensus model is one of the common methods of assessing team-level variables. It avoids issues of overestimation compared to group discussion approach, where team members discuss each item and provide a consensus response [59]. To assess the criterion for aggregation of the team-level variables, we used intraclass correlation coefficients ICC(1) and the within-group interrater agreement r_{wg}, which reflects the extent to which all members within the same group provided similar ratings [18; 33].

As our model is nested within a macro structure, i.e., members within the same team, there are potential shared variances among individual-rated measures due to non-independence [68] that could bias the standard error estimates. We therefore applied multilevel analyses using IBM SPSS 25 with maximum likelihood estimation to test our hypotheses [61]. Prior to testing the hypotheses, we centred the predictor variables (i.e., self-management, initiated and received task interdependence) using grand mean centring, which is the recommended option for variables at the team level [20; 54].

Results

First, we assessed the within-group interrater agreement r_{wg} of all team-level variables, i.e., team self-management, initiated and received task interdependence. For team self-management, all r_{wg} were above .70 ranging from .78 to 1.00 indicating strong agreement within teams.

However, one of the teams had the r_{wg} of .50, which indicated a moderate agreement [7]. For initiated task interdependence, two teams indicated moderate agreement with r_{wg} of .50 and .52 respectively, and the rest of the teams had strong agreement with r_{wg} ranging from .70 to 1.00. For received task interdependence, while three teams had moderate levels of agreement with r_{wg} of .52, .64 and .67, the rest of the teams had strong levels with r_{wg} ranging from .74 to 1.00. The within-team interrater agreement justified the aggregation of these three team-level variables. The intraclass correlations (ICC1) were .16 for team self-management, .15 for initiated task interdependence, and .13 for received task interdependence. Overall, the intraclass correlation coefficients indicate some amount of variance to be explained by the organizations of these teams.

Table 1 displays the means, standard deviations, and reliability coefficients for the measures in this study. To assess the convergent and discriminant validity of the constructs studied, we conducted confirmatory factor analyses (CFA) with maximum likelihood estimation procedures using AMOS. To do so, we first examined whether each item for measuring the dimensions of self-management, initiated task interdependence, received task interdependence and coordination had statistically significant factor loadings on the respective factors. The results reveal that the factor loadings were significant ($p < .01$) ranging from .49 to .98, supporting the convergent validity of the measures. For the divergent validity, the expected four-factor solution (self-management, initiated task interdependence, received task interdependence, and coordination) displayed an adequate fit with the data (chi-square [71] = 126.20, CFI = .93, RMSEA = .09). The comparative fix index (CFI) was greater than .90 [5], and the root mean square of error approximation (RMSEA) below .10 [45] indicate a moderately good fit. We then tested alternative nested models to examine whether a more parsimonious model achieved an equivalent fit. A three-factor solution with self-management and initiated task interdependence on the same factor yielded a poorer fit, chi-square [74] =

321.56, CFI = .69, RMSEA = .18. The same applied to a two-factor solution with self-management, initiated task interdependence and received task interdependence loading on the same factor, chi-square [76] =485,35, CFI = .49, RMSEA = .23. Lastly, the model with all latent variables on the same factor yielded the poorest fit, chi-square [77] = 604.91, CFI = .35, RMSEA = .26). Accordingly, the results support the four-factor solution, as suggested in our model.

Hypothesis 1 proposes that initiated task interdependence would positively moderate the positive relationship between team self-management and perceived team coordination. We regressed perceived coordination on team self-management, initiated task interdependence and received task interdependence, and their interaction terms together with the control variables. As shown in Table 2, all reported coefficients are unstandardized. The interaction between team self-management and initiated task interdependence was .31 and marginally significant with a p-value less than .10. We further assessed the simple slopes and plotted the relationships, as depicted in Figure 2, when initiated task interdependence was high versus when it was low [16].

Insert Table 1 about here

The relationship between team self-management and perceived coordination was positive and marginally significant (.43, $p < .10$) when initiated task interdependence was high. However, the relationship turned negative, although not significant (-.13, $p > .10$) when initiated task interdependence was low. Hypothesis 1 is thus not supported.

Insert Table 2 about here

In contrast, Hypothesis 2 proposes that received task interdependence would negatively moderate the positive relationship between team self-management and perceived team coordination. As expected, the interaction between team self-management and received task interdependence was negative and significant (-.40, $p < .05$). Further, the relationship between team self-management and perceived coordination was significant and positive (.49, $p < .05$) when received task interdependence was low. When received task interdependence was high, the relationship between team self-management and perceived coordination was negative, but non-significant (-.15, $p > .10$), supporting Hypothesis 2. Figure 2 illustrates their interacted relationships.

Insert Figure 2 about here

Discussion and Implications

The present study examined the moderating roles of initiated and received task interdependence on the relationship between team self-management and coordination in distributed teams. We investigated the roles of the two types of task interdependence as proxies for team interaction structure in distributed, autonomous teams – a commonly used work form within IS development. Our results indicate that the level of team self-management was positively associated with perceived coordination when the level of received task interdependence was low (H2). Thus, our findings suggest that in distributed, autonomous teams, initiated and received team task interdependence represent different team coupling structures that influence how team self-management may hinder team coordination. The

findings of the present study thus contribute to the literature on autonomous teams and team coordination by investigating autonomous team coordination dynamics and interaction structures in distributed settings. Such insight is important as commerce, collaboration, and communication are gradually shifting towards the digital marketplace [83; 84] and traditional modes of enabling team coordination are becoming less practical. Further, our work contributes to research on the dynamics of task interdependence. Currently, only a few studies have differentiated between initiated and received task interdependence [19; 53; 74]. Therefore, our results offer more knowledge on the distinctive features of initiated and received task interdependence.

Theoretical implications

Our results provide further insight into how team coupling structures, represented by their different types of task interdependence, may influence autonomous, distributed team coordination. Such insights are important, given the need for more knowledge on team dynamics in distributed settings [24; 84]. In addition, as previous research has suggested that coordination is important for team efficiency and performance [3; 22], it is essential to build knowledge on the complexity between task interdependencies and their moderating role in the relationship between team perceptions of self-management and coordination.

In particular, previous research has suggested that being a member of an autonomous team does not necessarily mean that individual team members feel self-managing or autonomous [43] or that setting up an autonomous team leads to self-coordinating team members [51]. Until now, the interaction patterns in distributed, autonomous teams have largely been unexplored, yet is increasingly of interest as the workforce continues to rely heavily on e-commerce-enabled work settings. The results presented in this study suggest that received task interdependence may play a crucial role with respect to distributed autonomous team

coordination, as it may influence how team members communicate and collaborate in digital settings.

Our findings indicate that initiated and received task interdependence represent different team coupling structures [19; 74]. This suggests that task interdependence as a whole may serve to tie distributed team members closer together by forming stronger intragroup couplings, resulting in increased contact and communication among team members [30; 57].

Further, our findings suggest that the perceived value of the two types of task interdependence may not be equal. An interesting notion arising from this is whether initiated and received interdependence may represent competing interaction patterns when team members are experiencing more or less of the two types of task interdependence. For instance, when individuals are depended on (that is, they initiate task interdependence), they may interact with their team members in different ways than if they are dependent upon others (i.e., received task interdependence). In the former case, they may feel, more effective and have a greater belief in the team's ability to perform its focal goals [74]. Alternatively, the knowledge that they are depended upon to provide by others may instil feelings of responsibility toward others [19; 74]. In both explanations, the outcome should be an inclination toward cooperative behaviours for overall team efficiency in solving tasks. The feelings of being responsible may foster their helping behaviours [65] and increase the frequency of communication with their fellow team members [62]. In an autonomous setting, both the felt responsibility for others and the increased interaction among team members may contribute to explaining why higher levels of team self-management were associated with higher levels of perceived coordination when initiated task interdependence was high.

In the latter case, individuals who perceive that they depend greatly on others are likely to feel powerless and that they have less information. These individuals might perceive that they rely on others to gain an overview of, and contribute to, the team's overarching objectives.

Consequently, they are more likely to be less engaged in the team [19; 36]. As such, high levels of received interdependence may be negative in terms of coordination outcomes, especially if the team is highly autonomous. Research in face-to-face settings suggests that higher levels of autonomy may be associated with increased task conflict and reduced trust in task-interdependent teams [40; 42]. Taking this further, the findings in our study imply that the potential coordination challenges an autonomous team faces may depend on the types of task interdependence team members have and/or feel to be dominating their work situation. As both received and initiated task interdependencies are inevitable in teamwork, having a regular stock check of how the two types of task interdependencies are balanced within distributed, autonomous team members may be important.

In addition, it is likely that employees who have more received task interdependence are acting in-role and could be encouraged more to act outside of their role (e.g., by communicating more with those whom they rely upon). Indeed, research on e-commerce has shown that the effectiveness of online community management, cooperative norms, technology readiness, and perceived benefits of participation all significantly affect in-role and extra-role participation [79]. Therefore, looking into how these two types of task interdependence may influence autonomous distributed team members in-role and extra-role participation would be fruitful.

Practical implications

Given the increasing relevance of distributed work arrangements, the findings of this study should be relevant to practitioners within the IS field and beyond. There are several benefits associated with organizing distributed, autonomous teams, such as increased flexibility and the opportunity to leverage individual team members' skills and competencies regardless of their geographical location [24; 63]. However, organizations and leaders seeking to reap the potential benefits of such teams need to be aware of the importance of different team task

interdependencies. Much research has focused on the benefits of e-commerce for selling, and at this point in time, it is reasonable to expect the same amount of focus on the benefits of e-commerce for effective virtual teams.

Good information flow, sufficient levels of team communication, and a focus on creating strong intragroup couplings within the team are all, in theory, potential ways of balancing the level of task interdependencies for optimal team coordination [22; 30; 60]. However, as distributed teams may experience communication challenges due to the reliance on computer-mediated communication [31; 62], leaders of such teams should ensure that the team leverages these challenges for better coordination [27]. This could be done by encouraging face-to-face meetings when possible, conducting meetings and team-building activities with rich media collaborative software and carefully choosing tools and information systems to support distributed communication [24; 31].

Team configuration should also be taken into account when designing for distributed autonomous teams, as it may influence team communication and coordination. Managers should consider the team composition, as different individual dispositions could be related differently to self-management and shared leadership [46], distributed teamwork [39], and potentially related to different reactions of initiated and received interdependence [74]. Further, research from in-depth qualitative field studies suggest that in order to nurture autonomous teams' sense of involvement and empowerment, the team should be involved in making decisions traditionally made by managers, such as resource allocation and task selection [50]. In particular, team involvement in task selection should be important for managing interdependence, as an autonomous team should best know how and when to approach their tasks.

Limitation and Future Research

Some limitations of the present research must be considered. First, the cross-sectional nature of the data does not allow us to assess causality and introduces the question of whether common method bias has impacted our results [1; 66]. As such, we cannot refute reverse causality, or that there could be a bidirectional relationship between the variables. Experimental or longitudinal studies are needed in order to assess the causality of the proposed relationships and to reduce the threat of common method bias in our results [1; 66].

Second, the construct measures in this study are perceptual. As the focus of our study was to capture the perceptions of distributed team members, these types of measures were deemed appropriate. However, their use also represents a threat of common method bias [1]. Thus, our choice of using perceptual measures was guided by an interest in capturing how these constructs are perceived by individual team members themselves [13]. In addition, the predictors and moderators (that is, self-management and the task interdependencies) were aggregated to the team level, while the outcome variable, coordination, was kept at the individual level. This may serve to reduce the threat of common method bias [58]. To strengthen and further develop our findings, we encourage further statistical analyses with more objective measures, and qualitative approaches. This could serve to shed additional light on the roles of initiated and received interdependence for team members' coordination.

Third, the generalizability of our results is restricted by the relatively small sample size, which may limit the accuracy and stability of the estimates [66]. However, as our sample consisted of employees from three international organizations, dispersed across geographical locations, our results therefore arguably reflect stronger external validity compared to research that focuses on a single organization and location [66].

Currently, our understanding of the roles of these two types of task interdependence in distributed teams is limited. Future research may investigate how the boundary structure

imposed by the two types of task interdependences may influence the dynamics of social capital within and across teams. While the success of autonomous teams is certainly affected by factors at the individual, team and organizational level of analysis [46], one avenue for future research is to continue the investigation of task interdependence in relation to autonomous team coordination. To better understand the interplay of initiated and received task interdependence, future research should continue to explore how these may relate differently to team dynamics. To this end, a field experiment comparing autonomous teams in distributed versus co-located settings would bring further insights into whether task interdependence does represent different interaction structures when team members do or do not meet on a daily basis. This method would also allow for a closer investigation of the impact that electronic dependence and reliance on information systems has on distributed team coordination.

Further, an interesting arena for future research is additional exploration of the role of task interdependence as a competing coupling structure representing different interaction patterns in teams relying on electronic communication for performing their daily task work. In our sample, electronic dependence was used as a control variable, since we wanted to ensure the variance nested in the wider work structure. We believe, however, that electronic dependence may be more important for team coordination than our current analyses allow us to understand. Moreover, task interdependencies are not the only form of interdependence in need of further exploration [14]. In addition, future research exploring the role of task interdependencies in relation to other interdependence constructs, such as technology interdependence [3; 65], represent potential contributions to the IS field.

Finally, an issue to consider is whether task interdependencies can be increased or reduced during the various phases of teamwork. Research suggests that high task interdependence may be more advantageous at earlier stages of teamwork [27], as it improves the connectedness among team members. On the other hand, it is costlier in terms of conflict and coordination

requirements at later stages [28]. As such, it will be interesting to investigate not only the types of task interdependencies but also their timing when designing and facilitating autonomous team processes.

Conclusion

As a concluding remark, the findings of this study contribute to highlighting the complexities of task interdependencies in distributed autonomous teams, which is a commonly used team setup in IS development teams. Results indicate that the level of team autonomy is positively associated with perceived coordination when initiated task interdependence is high, as well as when received task interdependence is low. This implores leaders to consider how their teams are set up, and researchers to further explore the intricacies of these findings. As the usage of distributed teams with high levels of self-management continues to spread, gaining such insights is important, both for researchers and for practitioners seeking to optimize the working environment for teams to coordinate effectively in an increasingly volatile, digitized age.

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Table 1. Descriptive Statistics, Correlations and Scale Reliabilities

		Mean	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13
1.	Age	41.33	9.62	-												
2.	Gender	1.34	.48	-.01	-											
3.	Education level	3.39	1.13	-.14	.07	-										
4.	Tenure	6.66	7.52	.50***	.20*	-.11	-									
5.	Dyad tenure	2.80	2.82	.13	-.12	-.19	.17	-								
6.	Managerial responsibility	1.67	.47	.20	-.05	-.07	.08	-.14	-							
7.	Employment fraction	1.02	.20	.01	.14	.06	.05	-.07	.07	-						
8.	Electronic dependence	5.88	.90	.15	.23*	.27*	.20	-.15	.03	.05	-					
9.	VTWS alignment	5.01	1.00	.07	.04	.16	.22*	-.02	.05	.00	.52***	-				
10.	Self-management[a]	5.15	.78	-.19	-.01	.14	-.06	-.15	-.17	-.06	.10	.20*	(.90)			
11.	Initiated task interdependence[a]	4.70	.87	-.02	-.05	.01	-.02	.14	-.07	-.01	.23**	.20*	.19***	(.90)		
12.	Received task interdependence[a]	5.37	.82	-.17	-.15	.02	-.13	.06	-.04	-.07	.12	.19	-.02	.64**	(.89)	
13.	Coordination	5.03	1.09	-.01	.09	-.05	.15	.10	-.14	.05	.26**	.46**	.19*	.32**	.04	(.78)

Note. Cronbach's alphas are displayed on the diagonal. $n_{indivudual} = 101$, $n_{team} = 31$. $^{*}p < .05$ $^{**}p < .01$ $^{***}p < .001$. [a]Team-level coefficients are shown.

Table 2. Regression Analyses and Slope Difference Results

Variables	Coordination			
	Model 1		Model 2	
	coefficients	SE	coefficients	SE
Intercept	3.01**	(.88)	3.06**	(.86)
Level 1 (individual level)				
Age	-.01	(.01)	-.01	(.01)
Gender	-.25	(.21)	-.23	(.20)
Education level	-.10	(.08)	-.12	(.08)
Team tenure	.04	(.03)	.05	(.03)
Employment fraction	.30	(.42)	.30	(.42)
Electronic dependence	.02	(.12)	.02	(.12)
VTWS alignment	.47**	(.10)	.47**	(.10)
Level 2 (team-level)				
Self-management (SM)[a]	.15	(.14)	.15	(.14)
Initiated task interdependence (ITI)[a]	.55**	(.17)	.55**	(.18)
Received task interdependence (RTI)[a]	-.47**	(.17)	-.47**	(.17)
SMxITI			.31†	(.19)
SMxRTI			-.40*	(.15)
Pseudo-R^{2}[b]	0.18		0.20	
ΔR^{2}			.02*	
Simple slopes	Gradient		*t*-value	
Low ITI	-0.13		-0.71 (*n.s.*)	
High ITI	0.43		1.85†	
Low RTI	0.49		2.15*	
High RTI	-0.15		-0.78 (*n.s.*)	

Note. Unstandardized coefficients are shown. $n_{indivudual} = 101$, $n_{team} = 40$. †p <.10 *p <.05 **p <.01. [a]Team-level coefficients are shown, [b]Calculated as 1 - (variance of full model/variance of null model).

Figure 1. Conceptual model

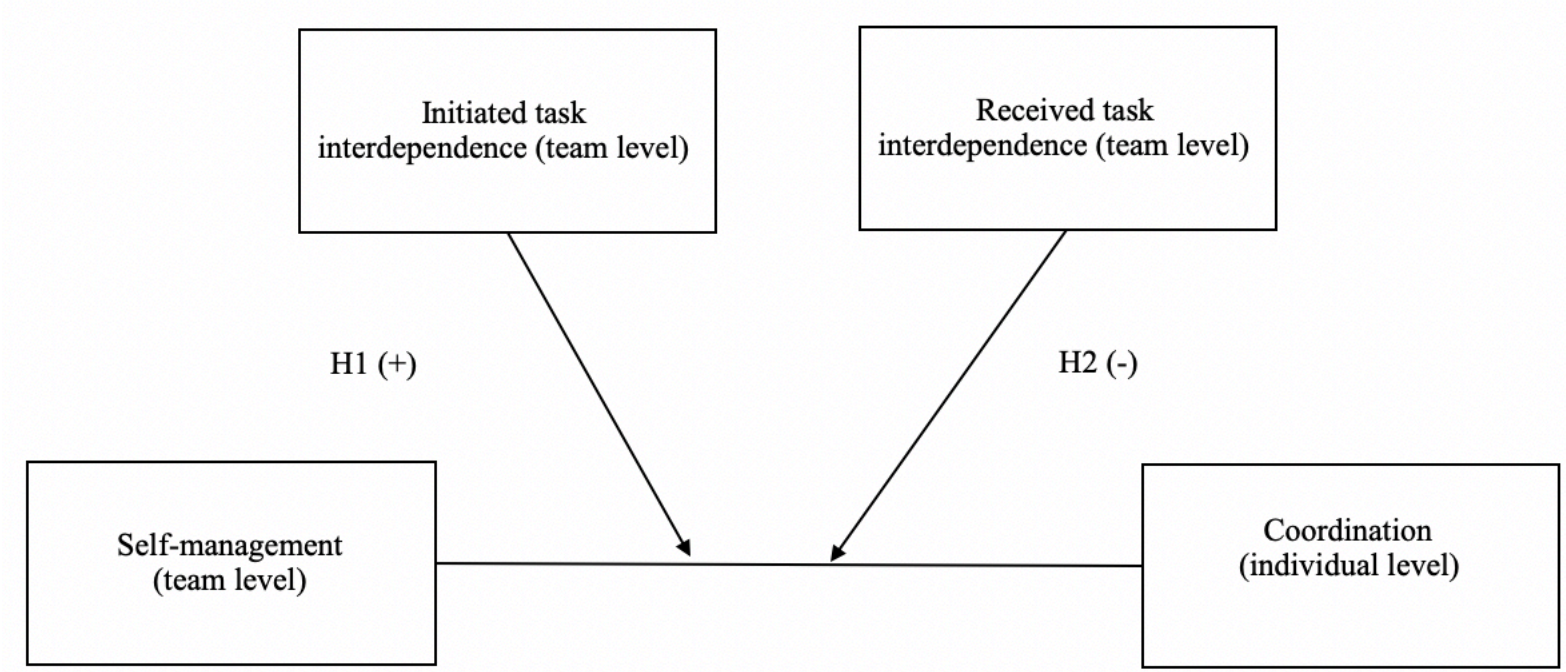
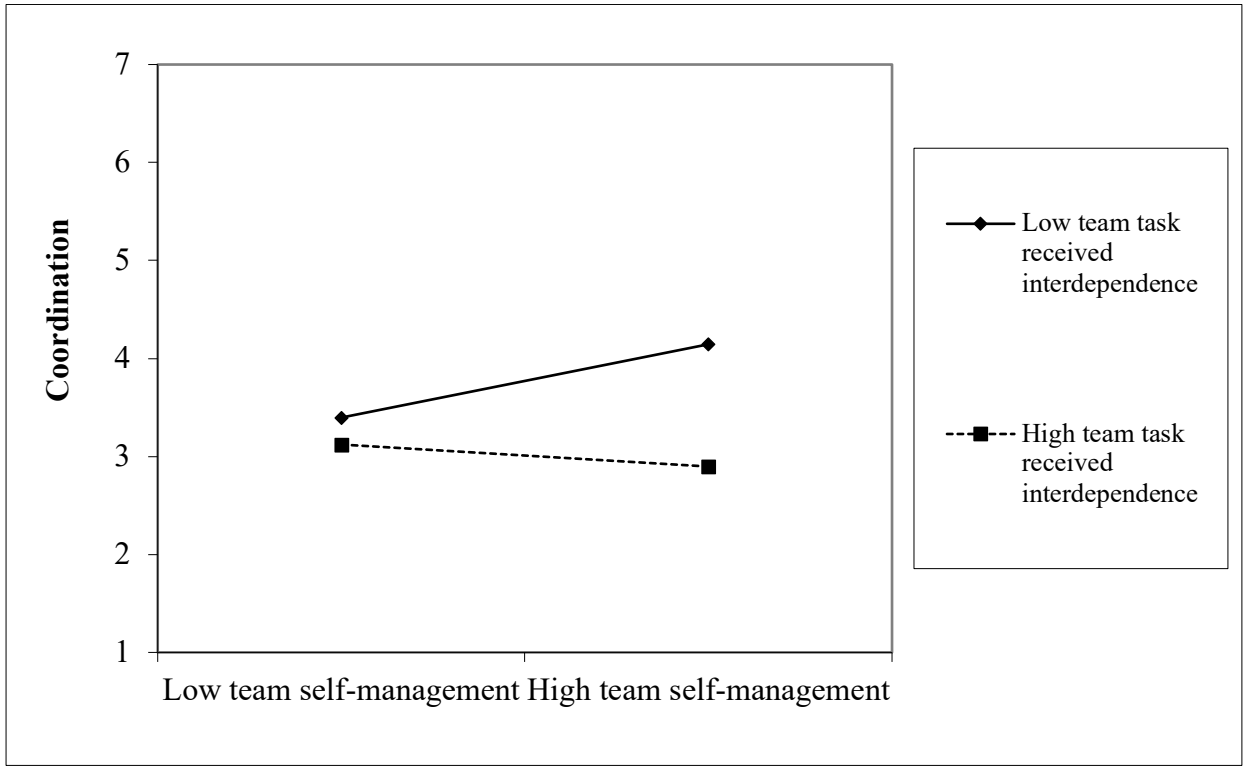


Figure 2. Two-way interaction between team self-management and team received task interdependence



Appendix – Measures

Self-management [67]

1. Members of this team are eager to take on the responsibilities traditionally reserved for management
2. Members of this team fully accept making more and more decisions, such as planning and scheduling work
3. Members of this team fully support taking on the responsibilities for production-related concerns

Initiated Task Interdependence [53]

1. The job requires me to accomplish my job before others complete their job
2. Other jobs depend directly on my job
3. Unless my job gets done, other jobs cannot be completed

Received Task interdependence [53]

1. The job activities are greatly affected by the work of other people
2. The job depends on the work of many different people for its completion
3. My job cannot be done unless others do their work

Coordination [44]

1. Our team works together in a well-coordinated fashion
2. Our team has very few misunderstandings about what to do
3. Our team needs to backtrack and start over a lot (reverse)
4. We accomplish tasks smoothly and efficiently
5. There is much confusion about how we can accomplish tasks (reverse)