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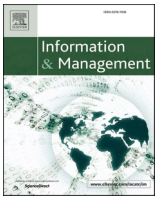

Telecommuting and job outcomes: A moderated mediation model of system use, software quality, and social Exchange

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ABSTRACT

This research investigates an artifact-centric view of the telecommuting experience, examining how system use and software quality influence job outcomes of telecommuters. We develop and test our moderated mediation model in a cross-organizational study of 184 teleworkers. Results show the extensive use of telecommuting systems negatively impacts social exchange processes and job satisfaction, organizational commitment, and job performance of telecommuters, underscoring limitations of virtual interactions. However, high-quality software can moderate this negative effect, because the negative relationship between telecommuting system use and job outcomes becomes nonsignificant, as telecommuting software quality increases.

1. Introduction

Telecommuting on a regular basis has increased 115 percent in the last decade in the United States, mirroring trends around the world [1]. Telecommuting can lower costs for organizations by minimizing the required investment in office infrastructure and real estate costs [2]. Further, it can be viewed as a benefit by employees and enables both organizations and individuals to reduce their overall carbon footprint [3]. Nonetheless, despite the potential advantages of telecommuting, recent industry surveys suggest an increasingly negative view of telecommuting [4], and numerous high-profile corporations—such as IBM, Yahoo!, and Bank of America—are dramatically reducing or eliminating telecommuting due to its suboptimal effect on job outcomes [5,6]. This suggests that organizations are responding to the potential negative impacts of telecommuting on job outcomes by enacting policies that limit worker flexibility. This backward step further suggests the need to reexamine the topic of telecommuting and job outcomes.

Despite the potential ambivalence of some organizations when it comes to telework, the onset of the COVID-19 pandemic has spurred an unprecedented move toward remote work, with some surveys suggesting approximately 50% of all knowledge workers transitioned to working remotely [7], with some indications that remote work may be here to stay even after the pandemic (see Venkatesh [8] for a discussion). This suggests that the issue of telecommuting and job outcomes will be critical in the short-, medium-, and long-term. Numerous issues related to jobs and the nature of work are identified as critical for researchers to study [8].

Research on relationships between telecommuting and job outcomes are often inconsistent. As an illustration, Bailey & Kurland's [9] survey of the literature revealed little clear evidence that telecommuting increases job satisfaction and productivity. In contrast, Gajendran & Harrison's [10] meta-analysis of 46 previous studies found that telecommuting has positive effects on job satisfaction and job performance. In addition, although Westfall [11] asserted that there is no evidence supporting the claim that telecommuting substantially increases productivity, Butler, Aasheim, and Williams [12, p.103] found "positive support that telecommuting increases productivity and, more importantly, that this increase is sustainable over time." Other contradictory findings include the effect of telecommuting on employee engagement. Although Sardeshmukh, Sharma, and Golden [13] found that telecommuting is negatively related to employee engagement, Masuda et al. [14] found that telecommuting has a positive effect on engagement. A recent review argued that lack of a plausible theoretical perspective in understanding the relationship between the telecommuter and

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organization is the fundamental problem associated with contradictory results of prior work [15,16].

In this work, we argue that greater theoretical integration of past work in information systems (IS) and organizational behavior (OB) may be a key to the increased understanding of telecommuting job outcomes. From an IS perspective, the telecommuting system—i.e., IT artifact [17] that serves to tether the telecommuter to the organization—is largely absent from past studies of telecommuting job outcomes. We utilize constructs of telecommuting system use, social presence, and telepresence to capture core components of the IT artifact relevant to this context. Second, from an OB perspective, we suggest linking mediating mechanisms associated with social exchange theory [18]—as characterized by both the constructs of leader-member exchange (LMX) and perceived organizational support (POS)—as a way to understand how telecommuting systems influence work outcomes. We use social exchange theory because it provides a known theoretical framework for social and psychological processes that underlie employees' behaviors toward the organization [19]. Taken together, our artifact-centric moderated mediation model examines social exchange as a mediating theoretical mechanism and software quality as a moderator in linking telecommuting system use to job outcomes (i.e., job satisfaction, organizational commitment, and job performance) of telecommuters. Rather than focusing only on telecommuting as a driver of job outcomes, we build a theoretical model that includes IS systems used for telecommuting.

Our work makes several contributions. First, we respond to calls for more theory-driven research on telecommuting and its impacts [e.g., [15], [20], [21]]. We used social exchange as the theoretical lens to understand the telecommuters' relationship to their manager and to the organization. Specifically, we found that relationships between telecommuting system use and job outcomes are mediated by LMX quality and POS, the two dominant constructs characterizing social exchange. Second, our results provide insights into limitations of the practice of telecommuting in organizations. We found that telecommuting system use can have a negative effect on job satisfaction, organizational commitment, and job performance of telecommuters. This indicates that there may be specific challenges when telecommuters are required to use a telecommuting system as the main connection to the organization for extensive periods of time when working remotely. This suggests that the extent to which individuals use telecommuting systems is negatively associated with job outcomes because telecommuting systems are limited in their ability to facilitate social exchange processes in the same manner as the traditional work environment. However, high-quality telecommuting software (i.e., software high in social presence and telepresence) can mitigate this negative effect, providing individuals with improved levels of social exchange and associated job outcomes. With increased accessibility and lower costs of high-quality immersive devices and software, technology has perhaps the largest opportunity to shift future outcomes related to telecommuting, making an artifact-centric perspective important for navigating the future of work and work policies. Finally, we enhance our understanding of telecommuting system use and its consequences, thus adding to the literature on IS use by studying the consequences of technology adoption, as opposed to its antecedents that have been extensively studied [for a review, see [22]].

2. Background

2.1. Telecommuting

Telecommuting has received a great deal of attention across many disciplines. In reviewing the extant literature, we identified three relevant streams that are useful to position our paper and its contributions: (1) studies that investigate factors affecting telecommuting adoption and use; (2) studies that examine telecommuting characteristics, predicting its consequences; and (3) studies that examine outcomes of telecommuting.

Early work in the IS literature addressed the issue of adoption of telecommuting and associated telecommuting systems. For instance, Wijayanayake and Higa [23] investigated the influential factors that affect the technology-selection behavior of telecommuters. They found that there are influential contextual (e.g., distance and task complexity), individual (e.g., telecommuters' experience with the technology), and social factors (e.g., friendship and management encouragement) that affect the media selection of telecommuters. Further, telecommuters' characteristics, such as background (e.g., education and income), occupation (e.g., information workers), employment (i.e., business owners vs. nonbusiness owners), and residency (i.e., suburban vs. urban), were predictors of telecommuters' patterns of Internet technologies used for telecommuting [24]. In a similar vein, Peters, Tijens, and Wetzels [25] indicated that organizational (e.g., size and hierarchy), occupational (e.g., working hours and computer use), individual (e.g., gender and age), and household characteristics (e.g., spouse and children) can influence telecommuting adoption. Finally, in a recent study, Kaplan et al. [26] examined factors that can drive managers' decisions about allowing or preventing their employees from telecommuting. They found that managers' trust in employees' conscientiousness and trustworthiness were the most important factors in allowing telecommuting.

Following the antecedents of telecommuting, the second stream of telecommuting research involves linking features and characteristics of the telecommuting context with job outcomes. For instance, Maruyama, Hopkinson, and James [27] found that controlling working hours or time flexibility was of major importance for telecommuters, contributing to positive work-life balance among them. Further, in a recent study, Nakrosiene, Bučiūnienė, and Goštautaitė [28] found that reduced communication with colleagues, managers' trust and support, and suitability of working at home are key factors affecting favorable outcomes of telecommuting. Research has also investigated a variety of contextual factors that can contribute to telecommuters' job outcomes includes social structures (i.e., genre rules) of communication tools [29], the perceived proximity of colleagues [30], individuals' social and intellectual capital [31], leader-member relationships [32], and the extent of telecommuting [33,34]. However, as noted earlier, there has been little treatment of the IT artifact in understanding job outcomes of telecommuters.

The third theme involves the consequences of telecommuting, particularly employee outcomes [e.g., 35, 36]. As such, it has been found that telecommuting was positively related to task and contextual performance [37] and job satisfaction and job performance [38–40]. However, telecommuting has been shown to negatively influence work exhaustion [13,41].

Organizations are complex systems and contradictory outcomes identified may be associated with context-specific interactions involving job design, personal preferences, etc. To better understand the role of telecommuting, we integrate these three streams of research—incorporating adoption, the features/characteristics of telecommuting, and associated job outcomes—with a direct focus on ways in which telecommuting influences social exchange as a well-established and theoretically grounded mediating mechanism important to job outcomes. In addition, we present *telecommuting system use* as an artifact-centric characterization of the degree to which an individual has adopted telecommuting and is consistent with much of the literature on system use. To characterize the features/characteristics of telecommuting, we again focus on an artifact-centric view that includes software quality. Telecommuting software with higher quality may result in additional adoption [42] and may further influence how the individual interacts with the organization. There is extensive and emerging literature on social exchange as an important way to understand job outcomes [43] and we believe that by incorporating this key mediating mechanism to characterize how telecommuters interact with the organization will help to alleviate inconsistencies in prior studies. Finally, we believe that a

moderated mediation model of telecommuting use, software quality, and social exchange is appropriate to characterize the associated impact on key job outcomes. Showing the mediating role of social exchange builds on recent theoretical work [21] and provides a more specific and richer theoretical understanding of the ways in which our artifact-centric view of telecommuting can influence job outcomes.

We review relevant research on telecommuting system use, telecommuting software quality, and social exchange theory. We then present specific hypotheses related to the model, shown in Fig. 1. We have further provided a summary of the literature on telecommuting systems in Table 1.

2.2. Telecommuting system use

Although there are undoubtedly a number of ways to describe the technological environment of workers, system use has become one of the primary mechanisms to understand the role of IT in the workplace [53–55]. When working outside of the office, the telecommuter is supported by a group of enabling technologies, such as hardware, software, and networking, that facilitate connection with the central office. We refer to this group of technologies as the *telecommuting system*. *Telecommuting system use* is thus defined as the extent to which a telecommuter uses the group of technologies as a means of connecting with the organization. Conceptualizing telecommuting system use as separate from the extent of telecommuting enables us to incorporate these differences in work activities as they relate to the use of the telecommuting system. Some jobs may require individuals to work independently; others may involve calling or emailing potential clients or addressing concerns of existing clients. When individuals are required by the nature of their work to connect with others within the company through a telecommuting system, that telecommuting system becomes a critical link to the company. The construct of telecommuting system use captures this distinction, incorporating what is argued to be an important aspect of the telecommuting experience relevant to job outcomes.

Conceptualizing telecommuting system use directly also distinguishes our work from previous studies that have relied on the extent of telecommuting assessed through the amount of time spent away from the office [34,56]. Previous research has identified the importance of the extent of telecommuting in characterizing the experiences of telecommuters [9,20], and found a curvilinear relationship between the number of hours per week away from the office working as a telecommuter and job satisfaction [39,40]. However, because jobs differ significantly in their daily activities and objectives, and thus their reliance on telecommuting systems [21], characterizing system use as time spent telecommuting may not fully capture the degree to which individuals use a telecommuting system when telecommuting. Hence, this work builds on prior research examining system use as well as the extent of telecommuting to further clarify the nature of the telecommuting experience. As discussed later in detail, we specifically measure the extent of system use and control for other variables that capture the extent of overall telecommuting.

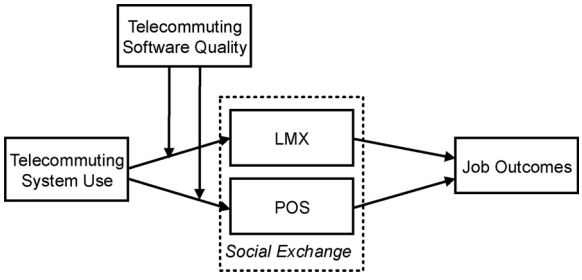

Fig. 1. Research model.

Table 1
Summary of the literature on telecommuting systems.

Papers	Telepresence	Social presence	System usage	Summary
[44]	X			Metaphorical mapping of virtual space can lead to telepresence.
[45,46,47,48]	X			Minimizing salience of technology through such things as high-speed video increases telepresence.
[49,50,51]		X		Social presence is associated with emotional connection between individuals.
[21,34,35,52]			X	Jobs differ extensively based on their activities and associated reliance on telecommuting systems.
[42]	X	X	X	Social presence and telepresence can lead to the greater adoption of telecommuting systems.
[23,24]	X	X	X	Aspects of the context (distance and task complexity) can affect technology selection.

2.3. Telecommuting software quality

Telecommuting systems play a critical role in providing the primary means by which telecommuters interact with the organization. Prior research has identified social presence and telepresence as important software design characteristics capturing how well the telecommuting systems support telecommuters [42]. Related to our work, Venkatesh and Johnson [42] found that software with better quality (i.e., higher levels of both social presence and telepresence) can result in favorable employee motivations to use the telecommuting system—higher levels of telecommuting. A diagram integrating the findings from Venkatesh and Johnson [42] with extensions proposed in this work is shown in Fig. 2. Thus, drawing on prior research, we use social presence and telepresence as key software design characteristics that together comprise overall telecommuting software quality.

The term *social presence* describes the affective social outcomes associated with the use of a communication technology [49,57]. Social presence differs from media richness in that media richness reflects the degree to which the software supports the *information processing outcomes* resulting from communication [58,59]. In contrast, social presence reflects the degree to which the software supports the *interpersonal relationship outcomes* of communication. Media exhibiting high levels of social presence are able to convey subtle expressions and cues to enable an emotional connection between individuals [49,50]. In effect, a telecommuting system high in social presence provides an environment that fosters the type of relations that are characteristic of face-to-face interactions in a traditional workplace.

Telepresence describes the ability of a technology (here, telecommuting system) to induce a perception of being present, either physically or psychologically, at a remote location [51,57]. For example, interactive collaborative software, such as Slack or Skype for Business, enables users to clearly indicate their ability to interact through a status representing their presence. Telepresence differs from social presence in that, although social presence involves the nature of the interaction with others, telepresence may involve interactions exclusively with the telecommuting system such as configuring a status to represent one's current activity. Telecommuting system features that create a sense of telepresence often employ one of two design strategies. First, the telecommuting system may create a sense of presence by giving the appearance of nonmediated communication [48]. Minimizing the

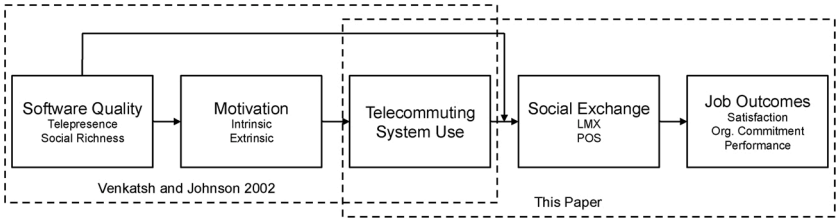

Fig. 2. Relationship to Venkatesh and Johnson [42].

salience of technology mediation through the use of high-speed video and audio leads to higher telepresence [45–47]. A second design strategy used to induce a sense of telepresence employs a shared virtual space [60]. The metaphorical reference to a shared virtual space induces a process of cognitive mapping between activities of the real and the virtual world [44]. For example, a telecommuting system could require a user to enter and leave a chat room, thereby creating the perception of going into and out of a virtual place, similar to going into and out of a conference room or physical room. This is widely used in chat applications that indicate if your friends are "available" for a chat or a video-conference, thus invoking a sense of a shared location.

Venkatesh and Johnson [42] found that social presence and telepresence are both higher in the case of an application designed with the metaphor of a virtual workplace in which specific actions associated with the work environment (e.g., arrival and departure) are incorporated into the user's experience. Investigation of telecommuting systems as well as commonly available instant messenger clients indicates that a common design characteristic is meant to incorporate aspects of both social presence and telepresence for these systems. As an illustration, messaging applications typically incorporate the ability to see when someone is online and interact with that person through chat messaging, audio, or video. For this reason, it can be expected that social presence and telepresence likely generally covary. As a result, we use the term *telecommuting software quality* as a way to characterize the quality of systems—i.e., their ability to provide social presence and telepresence—to support telecommuting.

2.4. Social exchange theory

Social exchange theory [18] describes social exchange as a process governed by reciprocity, involving the exchange of resources that can be economic or social in nature [18]. Social exchange has been applied to many aspects of the relationship between the employee and the organization, including citizenship behavior [e.g., 61,62], job design of IS workers [63], relationships with coworkers [43], and the performance of virtual teams [64]. Exchanges occur when resources given by one party are reciprocated by the receiving party at some future time in a way that is perceived to be equitable [65,66]. Although job performance and job satisfaction have been studied using a variety of theoretical perspectives, social exchange theory provides a useful lens to understand the transactional nature of the relationship between an employee and the organization [67].

LMX and POS represent two dominant constructs that capture different aspects of social exchange. LMX involves exchanges between the employee and his or her supervisor [for reviews, see [68,69]]. POS involves exchanges between the employee and the organization [for a review, see 70]. Although constructs of LMX and POS are theoretically and empirically distinct, their common foundation in social exchange often results in them being used jointly to capture different aspects of social exchange [e.g., [71] [72],]. Despite such prior research that has identified LMX as an important way of understanding the individual's relationship with others when telecommuting [36,40], LMX and POS have not been used together as a way to simultaneously examine telecommuters' relationships with their managers and organizations.

3. Model development

In this section, we first detail the relationship between social exchange variables and job outcomes, as shown in Fig. 1. We then describe the expected mediation involving social exchange. Finally, we detail the important role of software quality in moderating these mediated relationships.

3.1. Social exchange and job outcomes

Job satisfaction, organizational commitment, and job performance have been identified as key consequences of social exchange, with both LMX and POS influencing each job outcome. When an employee receives favorable treatment—i.e., high levels of LMX and/or POS—it creates positive affective outcomes as well as a sense of indebtedness and obligation to the source of the treatment. In accordance with the norm of reciprocity [73], the employee is motivated to repay the favorable treatment in a way that is valued by the exchange partner. When the exchange partner is the supervisor (i.e., LMX), reciprocal behaviors include meeting in-role job responsibilities as well as engaging in extra-role citizenship behaviors [74,75]. When the exchange partner is the organization (i.e., POS), appropriate reciprocal behaviors may include contributing to organizational goals and demonstrating loyalty through continued service [70,72]. In addition, both LMX and POS impact job outcomes through indirect efficiencies created by social exchange processes. LMX may improve employee effectiveness, as the ability to call upon knowledge, valuable resources, and the political clout of managers is critical to completing complex tasks, further contributing to the job performance of the employee [76,77]. POS may similarly contribute to employee effectiveness, as difficult problems can be more quickly solved with the information, knowledge, or valuable resources that are available through exchange processes with others in the organization [78,79]. High levels of LMX and POS may therefore lead to higher levels of job satisfaction, organizational commitment, and job performance, as frequent exchanges with managers and others in the organization help both to build relationships and to strengthen a sense of embeddedness in the organization [71,80].

3.2. Mediating role of social exchange

We expect social exchange to mediate the relationship between telecommuting system use and job outcomes, with increases in system use resulting in lower levels of job satisfaction, organizational commitment, and job performance. Higher telecommuting system use may involve lower-quality exchanges between individuals and their managers as compared to those that occur face-to-face, adversely impacting relationship quality development and maintenance. Whereas communication that occurs through the use of telecommuting systems is likely to lack the nonverbal and contextual indicators found in face-to-face interactions, such communication is likely to make the interpretation of interactions with the supervisor more difficult and filled with greater uncertainty [49,59,81]. Such difficulties in fully interpreting the interactions may thus preclude or hinder high-quality LMX relationships because such relationships are characterized by mutual trust and respect [68,71] that are not easily generated when interactions are ambiguous

or can easily be misinterpreted. In addition, Golden [40] found that more extensive telecommuting is associated with lower levels of LMX and feelings of isolation reported by telecommuters may be a manifestation of analogous limitations in social exchange processes [36,82]. In a similar way, an individual's POS is likely to suffer, as interactions with others who represent the organization are likely to be hindered by these same communication restrictions and ambiguities. Such exchanges are prone to uncertainties and associated distrust, thereby precluding or making less likely the formation of high levels of POS. Although individuals adapt rapidly to telecommuting system limitations to transmit information, the affective components of relationships are the most difficult to sustain when not interacting face-to-face [59,81]. Hence, such limitations inherent in telecommuting systems use are prone to adversely impact social exchange processes (i.e., LMX and POS), resulting in lower job satisfaction, organizational commitment, and job performance. We therefore hypothesize:

Hypothesis 1. LMX mediates the relationship between telecommuting system use and job satisfaction (H1a), organizational commitment (H1b), and job performance (H1c).

Hypothesis 2. POS mediates the relationship between telecommuting system use and job satisfaction (H2a), organizational commitment (H2b), and job performance (H2c).

3.2.1. Software quality and social exchange

Although social exchange variables are likely to mediate the relationship between system use and job outcomes, we expect the strength of these relationships to differ depending on the level of software quality, such that a system designed with better characteristics will reduce the negative effects associated with telecommuting system use. For any given level of telecommuting system use, this suggests that higher levels of software quality will enable enhanced levels of LMX and POS. In the following paragraphs, we first make arguments related to LMX and then make arguments related to POS.

3.2.2. Software quality and LMX

Telecommuting software quality will positively influence the relationship between system use and job outcomes through increased levels of LMX. Software that is high in social presence can contribute to enhancing the exchange relationship by improving the quality of the interaction, enabling both a sense of involvement and promoting positive impressions of the communication partner [49,83]. Prior work also suggests that managers communicate more effectively when they can efficiently match software characteristics with what is being communicated [84]. Managers with access to a telecommuting system that is high in social presence may have greater flexibility in this matching process, resulting in more effective communication outcomes. This may be particularly important in the context of telecommuting because exchange resources, such as emotion-laden feelings of positive affect and warmth, may not be able to be transferred through a telecommuting system low in social presence. If these interactions cannot take place through the telecommuting system and there is limited opportunity for face-to-face interaction due to telecommuting system use, the telecommuting system low in social presence is likely to hinder or prevent relationship development and maintenance, resulting in lower LMX quality and job outcomes.

Similarly, software that is high in telepresence can contribute to enhancing the exchange relationship by improving the quality of the interaction. Whereas colocation has been found to contribute to the quality of LMX relationships by creating the perception of availability and a positive pattern of communication [85], research suggests that the perception of presence provided by a system is as important as actual co-presence [86,87]. As a result, using a system that is perceived to provide higher levels of telepresence will likely trigger the employee's belief that his or her supervisor or other communication partner is mostly available and easily reachable. Recipient availability is a key factor that may determine the selection of media for communication when managers and employees have multiple options available to them [88]. Feelings of copresence have also been found to facilitate positive patterns of social communication [89,90]. In this way, telepresence may act as a facilitating mechanism to promote the types of leader-member interactions that occur naturally in a traditional face-to-face social exchange. When telepresence can facilitate interactions between the individual and their supervisor, higher LMX and work outcomes are likely to result. In sum, telecommuting software quality (in the form of greater social presence and telepresence) will reduce the strength of the negative relationship between telecommuting system use and job outcomes through LMX. We therefore hypothesize:

Hypothesis 3. Software quality will moderate the strength of the mediated relationships between system use and job satisfaction (H3a), organizational commitment (H3b) and job performance (H3c) through LMX, such that the mediated relationship will be weaker under high software quality than under low software quality.

3.2.3. Software quality and POS

Telecommuting software quality will also positively influence the relationship between system use and job outcomes through increased levels of POS. Software that is high in social presence can contribute to enhancing the exchange relationship by improving perceptions of job conditions. Perceptions of favorable and satisfying job conditions have been found to have a positive influence on POS, particularly when the organizational actions that result in favorable conditions are perceived to be both intentional and voluntary [91,92]. Whereas research on telecommuters has identified social and professional isolation as a potential problem [34,93], actions of the organization aimed at alleviating this isolation are likely to be interpreted by telecommuters as organizational efforts to improve their job conditions. This assertion is supported by Bélanger, Collins, and Cheney [52] who found that telecommuters with better hardware have higher levels of job satisfaction. By behaving in ways that demonstrate that the organization values the experience and job satisfaction of the telecommuters, the organization signals that they are valued, thereby inducing a higher level of POS. In other words, to the extent that telecommuters feel valued by the organization as a result of being provided with a telecommuting system that makes their job conditions better, they will have a higher level of POS. With more system use and a higher social presence in the telecommuting system, higher levels of POS are likely to occur, resulting in more positive job outcomes.

Similarly, software that is high in telepresence can contribute to enhancing the exchange relationship by improving perceptions of fairness. Perceptions of fairness or procedural justice, have been identified as highly influential in determining POS because providing employees with the opportunity to be involved in the processes that impact them is a key way to indicate that they are valued by the organization [70,94]. Telecommuting research has indicated that the absence from the workplace may generate perceptions of lower procedural justice because individuals are less able to take an active role in the processes that may impact them [95]. In addition, the absence from the workplace may create perceptions that telecommuters will be passed up for promotions or miss other opportunities for advancement [96]. In effect, the perception of being absent from the workplace and the corresponding fear that hard work on behalf of the company will not be reciprocated with the appropriate organizational rewards may negatively influence POS. Hence, although telecommuting systems with high levels of telepresence can induce the same types of cognitions as actual physical copresence [86,87], telecommuters provided with a system high in telepresence are likely to be more aware of the organizational processes that affect them, leading to higher levels of POS and associated job outcomes. In sum, telecommuting software quality (in the form of greater social presence and telepresence) will reduce the strength of the

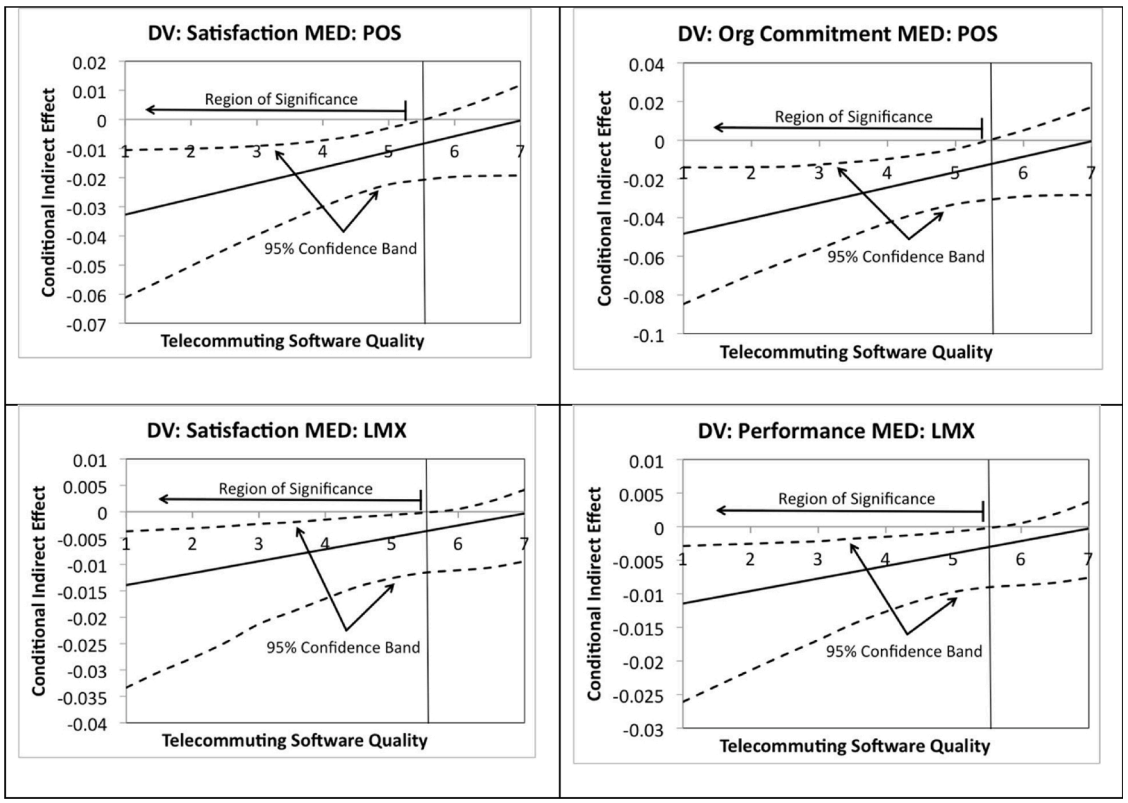

Fig. 3. (A–D) Conditional indirect effect of system use on job outcomes.

negative relationship between telecommuting system use and job outcomes through POS. We therefore hypothesize:

Hypothesis 4. Software quality will moderate the strength of the mediated relationships between system use and job satisfaction (H4a), organizational commitment (H4b), and job performance (H4c) through POS, such that the mediated relationship will be weaker under high software quality than under low software quality.

4. Method

4.1. Participants

We partnered with leaders from the Future of Work Institute (FWI) to conduct a cross-organizational survey. FWI had developed a mailing list of organizations and individuals with an interest in telecommuting. As we were interested in understanding the role of different IT artifacts available to support telecommuting, a cross-organization sample was appropriate and FWI supported the research by sending our survey to its mailing list.

Individuals were incentivized to take part in the research through the offer of a prize (gift card) and a summary of findings from the survey. We used screening questions to eliminate people from the pool of initial respondents who worked in very small organizations (fewer than five employees) and to include those who telecommuted at least part of the week. Of the 1230 individuals in this initial pool, 1046 were screened out or failed to complete the survey, resulting in 184 completed responses (also the approximate minimum sample size needed for our analyses). Although the number of telecommuters compared to the overall population of workers was relatively small, it is not unusual to have only a portion of the workforce that worked away from the office for part of the work week.

4.2. Measures

In measuring telecommuting system use, we first narrowly described the telecommuting system as the enabling technologies that support telework. Then, rooted in earlier research [33], we measured telecommuting system use by asking the individual to estimate "in an average or typical week, approximately how many hours are you using the telecommuting system?" The social presence of the telecommuting system was measured using the 4-item scale of Short, Williams, and Christie [49]. This captured individual perceptions of how sensitive, warm, personable, and sociable, the telecommuting system is perceived to be on a 7-point bipolar scale (i.e., respondents indicate their ratings with anchors *insensitive-sensitive, cold-warm, impersonal-personal,* and *unsociable-sociable*). Telepresence was measured by combining Slater, Usoh, and Steed's [51] depth of presence scale and Kim's [97] scale of capturing perceptions of arrival and departure. Perceived organizational support was measured using a short version (four items) of Eisenberger, Cummings, Armeli, and Lynch's [92] scale. We used a shortened version (four items) of the LMX scale that has been recommended as the standard measure for LMX [69]. Single-item measurements for job satisfaction have been shown to be appropriate [98,99] and thus we used a single question adopted from O'Reilly and Caldwell [100] that asked individuals their level of agreement with the statement "Overall, I am satisfied with my job." For organizational commitment, we used O'Reilly and Chatman's [101] three-item scale. To measure job performance, we asked individuals for their supervisor's rating from their most recent performance review. Single-item measures have a long history in industrial psychology and human resource management when assessing employees and potential hires [102], and recent work on predictive models has broadly suggested that single-item measures perform just as well in contexts of prediction [103,104]. Additional controls included the percentage of the week that the individual worked away from the office, the total number of hours worked from home, the total number of hours worked from other locations, the individual's age, gender,

Table 2
Descriptive statistics and correlations.

		Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Hours Home	20.87	13.49																
2	Hours Other	9.43	15.1	0.01															
3	% Away	47.62	81.5	0.27*	0.01														
4	Age	4.44	1.2	−0.03	0.01	0.00													
5	Gender	0.54	0.5	−0.03	−0.07	0.05	−0.25*												
6	Employees (K)	11.22	46.60	0.11	−0.07	−0.02	−0.01	−0.03											
7	Experience (yr)	25.81	11.57	−0.09	−0.15	0.06	0.60*	−0.17*	0.07										
8	Telework (yr)	5.01	5.71	0.13	0.02	0.03	0.22*	0.01	−0.07	0.26*									
9	System Use (h)	19.43	15.57	0.51*	0.07	0.11	0.07	−0.12	0.10	−0.04	0.09								
10	Social Presence	4.71	1.19	0.00	−0.04	0.08	0.07	−0.15*	0.02	−0.08	0.04	0.22*							
11	Telepresence	4.62	1.32	−0.03	−0.03	0.09	0.00	−0.02	−0.08	−0.18*	−0.02	0.18*	0.66*						
12	Soft Qual (SQ)	4.67	1.14	−0.02	−0.04	0.09	0.04	−0.10	−0.03	−0.13	0.01	0.22*	0.93*	0.90*					
13	LMX	5.43	1.24	−0.07	−0.06	0.07	−0.03	−0.04	−0.11	−0.03	−0.08	−0.15*	0.28*	0.34*	0.34*				
14	POS	5.20	1.36	−0.02	−0.02	0.08	−0.09	−0.06	−0.11	−0.15*	−0.08	−0.12	0.26*	0.31*	0.31*	0.69*			
15	Job Sat	5.45	1.44	−0.08	0.02	0.06	−0.03	−0.04	−0.08	0.01	0.02	−0.11	0.28*	0.30*	0.31*	0.61*	0.69*		
16	Org Comm	5.20	1.46	−0.11	0.01	0.07	−0.04	0.01	−0.09	−0.06	−0.04	−0.12	0.21*	0.25*	0.25*	0.59*	0.80*	0.72*	
17	Job Perf	5.86	1.07	0.07	−0.04	0.14	−0.02	0.14	−0.16*	0.05	0.02	0.05	0.26*	0.28*	0.30*	0.40*	0.34*	0.44*	0.32*

K = thousand; *$p < 0.05$.

experience, and years of telecommuting, and the number of employees in the firm. These variables enabled us to control the overall extent of telecommuting as well as important demographic variables that may influence the individual's incentives to telecommute. A list of the measures is shown in Appendix A.

5. Results

Convergent and discriminant validity were each assessed using partial least squares (PLS) and covariance-based structural equation modeling (SEM). Cronbach's Alpha, the composite reliability, the square root of the average variance extracted (AVE), and correlations for all reflective constructs are shown in Table C1. In each case, Cronbach's Alpha was greater than 0.80, the composite reliability exceeded 0.70 [105], and the AVE exceeded both 0.707 and correlations between constructs [106]. Further, social presence and telepresence were extremely highly correlated with each other than with other constructs, supporting the choice to model these as a second-order formative construct (software quality) made up of two underlying reflective factors [107]. SEM further confirmed that the measurement model exhibited a good fit (Chi-Square = 173.13, df = 139; $p = 0.026$; RMSEA = 0.037; GFI = 0.913; AGFI = 0.880; NFI = 0.949; and CFI = 0.989), as CFI, GFI, and NFI statistics were above 0.90, AGFI above 0.80, and RMSEA below 0.04. All path t-values were significant and the lambda coefficients were above 0.70, indicating convergent validity. However, as Mardia's [108] test of multivariate kurtosis (456.56, $p < 0.001$) demonstrated that the assumption of multivariate normality was violated [109], we used the factor results from PLS.

Factor scores from the PLS analysis, including software quality as a second-order factor composed of telepresence and social presence, were used for subsequent regression and moderated mediation analysis. Robustness checks confirmed that factors generated by PLS were highly correlated with factors generated by the SEM analysis (>0.98). Further details on the measurement model are shown in Appendix B.

The model, as specified in Fig. 1, requires moderated mediation analysis. Thus, overall testing of relationships required the use of both hierarchical regression and moderated mediation analysis [110,111]. Although the hierarchical regression gives information about the variance attributable to each set of variables included in the analysis and the statistical significance of each relationship, the regression analysis does not allow a full test of the conditional indirect effect—i.e., the indirect effect of system use on job outcomes through the LMX and POS mediators, conditional on the level of software quality. For this, we utilized bootstrap analysis methods outlined by Preacher, Rucker, and Hayes [111] to test the conditional indirect effect. The unstandardized PLS factor output for software quality was multiplied directly with the measure of system use to generate the interaction effect. These methods calculated the coefficient, significance level, and confidence interval at a variety of levels of the moderator variable. In other words, it calculated whether increases or decreases in the software quality results in changes in the overall effect of system use on job outcomes through LMX and POS. Specifically, we calculated the effect at plus or minus one standard deviation of software quality (as reported in Table 3). In addition, calculations of the relationship along the full range of software quality were used to develop graphs of the significant interaction effects and the associated regions of significance (as shown in Fig. 3A–D).

Table 2 presents the reliabilities, descriptive statistics, and correlations for all variables. Hypothesis 1 proposed that social exchange will mediate the relationship between system use and job outcomes. Hierarchical regression analysis was used to test for mediation, with additional steps included to test the interaction effect and to attribute variance to the control variable. Results from the hierarchical regression are shown in Table 3.

We found that, after controlling for a variety of aspects of how individuals telecommute, system use was negatively related to LMX ($\beta = -0.023$, $p < 0.001$) and POS ($\beta = -0.022$, $p < 0.001$), supporting

Table 3
Regression results.

	Job satisfaction				Organizational commitment				Job performance				LMX			POS		
Variables	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(1)	(2)	(3)
Step 1																		
Hours Home	−0.011	0.003	0.003	−0.005	−0.014	−0.002	−0.002	−0.011$^{\Psi}$	0.007	0.011$^{\Psi}$	0.011$^{\Psi}$	0.009	−0.007	0.009	0.009	−0.005	0.011	0.011
Hours Other	0.002	0.006	0.004	0.006	−0.000	0.003	0.001	0.004	−0.002	0.001	−0.001	−0.000	−0.006	−0.001	−0.003	−0.005	−0.001	−0.003
% Away	0.002	0.001	0.001	−0.000	0.002	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.002	0.001	0.001
Age	−0.094	−0.152	−0.184$^{\Psi}$	−0.115	−0.001	−0.042	−0.074	−0.002	−0.061	−0.115	−0.146+	−0.117	−0.031	−0.078	−0.108	−0.005	−0.047	−0.078
Gender	−0.186	−0.102	−0.083	0.035	−0.032	0.027	0.045	0.200	0.309$^{\Psi}$	0.394*	0.412**	0.443**	−0.157	−0.090	−0.073	−0.257	−0.199	−0.181
Employees	−0.000	−0.000	−0.000	0.000	−0.000	−0.000	−0.000	0.000	−0.000*	−0.000*	−0.000*	−0.000*	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000
Experience	0.003	0.016	0.019	0.020*	−0.010	−0.000	0.003	0.007	0.012	0.022*	0.025**	0.024**	−0.003	0.009	0.012	−0.020$^{\Psi}$	−0.009	−0.007
Yrs. Telework	0.009	0.004	0.005	0.017	−0.002	−0.006	−0.006	0.007	−0.006	−0.010	−0.010	−0.005	−0.015	−0.019	−0.019	−0.010	−0.014	−0.013
Step 2																		
System Use		−0.019*	−0.069**	−0.014		−0.017*	−0.067*	−0.004		−0.004	−0.051**	−0.031$^{\Psi}$		−0.023***	−0.068**		−0.022**	−0.070**
Soft Qual (SQ)		0.474***	0.248$^{\Psi}$	0.087		0.363***	0.135	−0.039		0.337***	0.120	0.056		0.442***	0.234$^{\Psi}$		0.406***	0.188
Step 3																		
Use x SQ[1]			0.010*	0.003			0.010$^{\Psi}$	0.001			0.010**	0.007*			0.009*			0.010*
Step 4																		
LMX				0.238**				0.078				0.197*						
POS				0.559***				0.826***				0.094						
R^2	0.024	0.152	0.171	0.536	0.031	0.107	0.126	0.660	0.076	0.188	0.221	0.300	0.034	0.196	0.218	0.055	0.171	0.191
Adj. R^2	−0.020	0.103	0.118	0.501	−0.014	0.055	0.070	0.634	0.033	0.141	0.171	0.247	−0.010	0.149	0.168	0.012	0.123	0.139
Change in R^2		0.128***	0.019*	0.365***		0.076***	0.019$^{\Psi}$i	0.534***		0.113***	0.032**	0.079***		0.116***	0.020*		0.162***	0.022*
F	0.543	3.099***	3.230***	15.10***	0.693	2.074*	2.259*	25.406***	1.792$^{\Psi}$i	4.015***	4.427***	5.605***	1.270	3.572***	3.697***	0.764	4.212***	4.356***

Notes: $N = 184$; $^{\Psi}p < 0.10$*, $p < 0.05$, **$p < 0.01$, and ***$p < 0.001$.

[1] Conditional interaction effects for job satisfaction, organizational commitment, and job performance calculated using bootstrap analysis at mean level of software quality per Preacher et al. [111]. The relationship at different levels of software quality is shown in Fig.3A–D.

Table 4
Conditional indirect effect of system use on job outcomes.

DV	Mediator	Conditional indirect effect at	Coefficient	95% Confidence interval	95% Confidence interval
Job Satisfaction	POS	Mean - 1 SD	−0.019**	−0.034	−0.008
Job Satisfaction	POS	Mean	−0.013*	−0.024	−0.004
Job Satisfaction	POS	Mean +1 SD	−0.007	−0.020	0.002
Job Satisfaction	LMX	Mean - 1 SD	−0.008*	−0.019	−0.002
Job Satisfaction	LMX	Mean	−0.006*	−0.014	−0.001
Job Satisfaction	LMX	Mean +1 SD	−0.003	−0.011	0.000
Org Commitment	POS	Mean - 1 SD	−0.028**	−0.049	−0.012
Org Commitment	POS	Mean	−0.019**	−0.034	−0.006
Org Commitment	POS	Mean +1 SD	−0.010	−0.029	0.003
Org Commitment	LMX	Mean - 1 SD	−0.003	−0.010	0.002
Org Commitment	LMX	Mean	−0.002	−0.007	0.001
Org Commitment	LMX	Mean +1 SD	−0.001	−0.006	0.000
Job Performance	POS	Mean - 1 SD	−0.003	−0.010	0.001
Job Performance	POS	Mean	−0.002	−0.007	0.001
Job Performance	POS	Mean +1 SD	−0.001	−0.006	0.000
Job Performance	LMX	Mean - 1 SD	−0.007*	−0.014	−0.002
Job Performance	LMX	Mean	−0.005*	−0.011	−0.001
Job Performance	LMX	Mean +1 SD	−0.002	−0.009	0.000

$N = 184$; $^{\Psi}p < 0.10$, $^{*}p < 0.05$, $^{**}p < 0.01$, and $^{***}p < 0.001$.

condition 1 for mediation for all cases. For condition 2, we found that system use was negatively related to job satisfaction ($\beta = -0.019$, $p < 0.05$) and organizational commitment ($\beta = -0.017$, $p < 0.05$) but not job performance ($\beta = -0.004$, $p > 0.10$). As shown in model 4, relationships between LMX/POS and job satisfaction were significant ($\beta = 0.238, p < 0.01; \beta = 0.559, p < 0.001$), whereas the relationship between use and job satisfaction became nonsignificant, thus supporting conditions 3 and 4. The relationship between POS and organizational commitment was significant ($\beta = 0.826, p < 0.001$) and the relationship between LMX and job performance was significant ($\beta = 0.197, p < 0.05$). We further assessed the significance of the mediation using Sobel's test for indirect effects. Results in each case corresponded with results from hierarchical regression. Overall, the results indicated support for H1a, H2a, H2b, and partial support for H1c.

We also tested 4 criteria to assess hypotheses related to moderated mediation [111,112]: (1) significant effects of system use on LMX and POS, (2) significant interaction between system use and software quality, (3) significant effect of LMX and POS on job outcomes, and (4) differential effects of system use on job outcomes through LMX and POS with low and high levels of software quality. Criterion 4 is key, as it captures the essence of moderated mediation [111].

Results from the hierarchal regression were used to test criteria 1–3 of the moderated mediation analysis. We used the bootstrapping procedure outlined by Preacher et al. [111] to test the standard error, confidence interval, and conditional indirect effects at different levels of the moderator. Results from the analysis at the mean, plus one standard deviation, and minus one standard deviation are shown in Table 4. The conditional indirect effect from system use to job satisfaction through LMX and POS, to organizational commitment through POS, and to job performance through LMX all show changes in relationship strength at different levels of system quality. In each case, coefficients increase in strength when software quality is low (minus 1 standard deviation) and become nonsignificant when software quality is high (plus 1 standard deviation), thus supporting H3a, H3c, H4a, and H4b. Fig. 3, A–D, contains graphs for each relationship in which moderated mediation was supported. In each case, the coefficient between use and job outcomes decreased in magnitude (and became nonsignificant), as software quality increased. H3b and H4c were thus not supported.

5.1. Common method bias

As a single respondent provided both the independent and dependent variables, we checked for common method bias using the method suggested by Podsakoff et al. [113] and Liang et al. [114] that compares the variance explained by a single factor linked to all other constructs with the substantive factors in the model. Results from this analysis show that the average variance explained by the substantive factors (constructs of interest) was greater than their method variance, thus alleviating concerns about common method bias.

5.2. Robustness checks and importance analysis

We performed several additional analyses to examine the robustness of results and alternate specifications for the model. First, as past work has suggested the potential of nonlinear effects related to the extent of telecommuting [40], we tested for nonlinear effects for both our controls involving the extent of telecommuting (% away, hours home, and hours other) and system use using hierarchical regression analysis. In each case, we found that the coefficient of the nonlinear term and the change in R^2 were not significant, indicating that the linear model is supported and that there is no evidence of a curvilinear relationship.

Second, our overall model used system quality as a formative construct consisting of highly correlated factors of social presence and telepresence. As an alternative, we analyzed models in which (1) only social presence and (2) only telepresence were used in the analysis as a substitute for overall software quality. In each case, we obtained results consistent with results using software quality. This suggests that improving either social presence or telepresence will improve job outcomes of telecommuters.

Finally, as factors for social presence and telepresence were highly correlated, we modeled the eight measures together as a single factor. For this model, all item loadings were greater than 0.75 and results of the moderated mediation analysis were consistent with findings involving the second-order factor. Overall, these robustness checks confirmed that our results were not dependent on choices made related to the modeling of software quality.

6. Discussion

In recent years, a number of reputable corporations, such as IBM, Yahoo!, Bank of America, and Best Buy, have decided to recall their remote-work employees to improve productivity [5,6]. Motivated by the leading companies' recent efforts to abandon their telework initiatives in today's digital world, we revisited the phenomenon of telecommuting. Nonetheless, the onset of COVID-19 has spurred several organizations to move to significantly expanded remote work [7,8]. We used social exchange as our guiding theoretical lens and found that social exchange processes mediated the relationships between telecommuting system use and job outcomes. Cumulatively, our findings provide compelling evidence that social exchange processes played a

critical role in explaining relationships between telecommuting and job outcomes, and software quality moderated the strength of relationships. This suggests that the organizational dubiety of performance outcomes of telecommuting may in part be due to limitations in social aspects of telework processes. Social aspects of work support broad organizational goals, such as the transfer of knowledge and the creation of social capital, both of which are critical processes that enable firms to develop competitive advantages [115]. Hence, limitations of remote work environment may be adequately addressed through the use of a telecommuting system high in social presence and telepresence—and this issue will continue to be relevant at least until the end of the COVID-19 pandemic and/or the end of remote work due to COVID-19, which may well continue long after the pandemic ends or even become a permanent feature of work life in organizations such as Twitter.

6.1. Theoretical contributions

Our work makes important contributions to research in IS and OB by testing a comprehensive theoretical model that acknowledges limitations of telecommuting system use and offering solutions (i.e., a telecommuting system with superior social presence and telepresence quality) to ease restrictions of working remotely. In doing so, this work provides a central role for the IT artifact in explaining differences in job outcomes of telecommuters and conflicting findings related to the amount of telecommuting.

Next and related to our first contribution, we expand the nomological network of telecommuting system use by theorizing about the moderating role of software quality—a construct incorporating social presence and telepresence. We found that software quality can reduce the strength of negative effects associated with telecommuting system use, rendering them nonsignificant at high levels of software quality. This suggests that technologies facilitating rich interactions among coworkers can improve work processes and related job outcomes of telecommuters.

Finally, we enhance our understanding of the consequences of telecommuting system use. More broadly, our work answers the call for research to understand the impact of technology on individual and organizational outcomes through alternative theoretical perspectives [e.g., [116]]. Our model provides a general framework to integrate system use, technology characteristics, and a moderated mediation model that both shows complementarities and the mediating theoretical mechanism to understand job outcomes (see [8]). An important implication of testing models, such as the one examined here, is that there must be adequate variance in the technology examined. This is often difficult in studies involving a single company or customers from a single website. We obtained a sample of individuals from a variety of organizations and with varying technology deployments, enabling us to further enhance our understanding of the mediating mechanisms through which telecommuting systems influences important organizational outcomes.

6.2. Managerial implications

We used importance-performance map analysis [117] as a way to further understand the relative importance of constructs of the model in influencing job outcomes. For each outcome, software quality was in the top-2 constructs ranked by overall importance, exceeded only by POS (in the case of job satisfaction and organizational commitment). Specifically, it is clear that telecommuting technologies high in social presence and telepresence can create a better social exchange between a telecommuter and his/her supervisor and the organization. Thus, the two software design characteristics can serve as a way for organizations to evaluate competing telecommuting system solutions. Therefore, even if employees hold favorable views of overall LMX and POS, a telecommuting initiative with a system weak in social presence and telepresence could erode the overall perceptions of social exchange and hurt associated job outcomes.

The relatively low importance of telecommuting system use and other controls capturing the amount of telecommuting suggests that rather than relying solely on the absolute amount of telecommuting, as has been the focus of prior research, it is important to incorporate the role played by the quality of systems available to telecommuters. The tremendous growth of social technologies, such as Facebook and Twitter, as well as rich communication technologies, such as Skype/Webex, further signals the need of individuals to connect with others and the power of technology to fill this need. Although marketing has long recognized the potential of social technologies, this research suggests that there may be a broader role for them within the enterprise—particularly among telecommuters, virtual teams, and virtual organizations. Social technologies facilitate the sharing of information and interests often without direct purpose or objective, and individuals often naturally blend topics related to professional and personal topics. This integration may thus facilitate the types of interactions that happen when face-to-face, as individuals seamlessly transition between professional and personal topics when meeting over lunch or at the coffee machine [or water cooler]. In contrast, this natural blend is unlikely in communications occurring over email, where the message is typically linked with a specific task or objective.

As noted at the outset, the onset of the COVID-19 pandemic and the changes that have been brought forth to the nature of work means that organizations and employees are suddenly finding themselves engaged in telework, whether they want it or not. This requires that designs of telecommuting systems to rapidly evolve and adapt to a range of jobs and worker skill levels. This work provides the first steps for practitioners in the journey of deploying telecommuting systems that meet the needs of this diverse population. Current market leaders appear to be Microsoft Teams and Zoom, but research and practice will need to consider a variety of factors—including those that we have found here—to ensure favorable job outcomes.

6.3. Limitations and implications for future research

There are limitations and consequent implications for future research that should be noted. First, our research necessarily focused on software design characteristics that were relevant to the important context of telecommuting, but there may be others that enable a more complete characterization of technologies. Future work can build on this and identify technology platforms which provide differentiated user experiences related to social richness and telepresence. In particular, augmented reality promises to more closely integrate hybrid telecommuting environments, allowing some individuals to more fully experience exchange interactions while working remotely. Moreover, virtual reality promises to more closely mimic in-person experiences in terms of social presence and telepresence and may offer increased opportunities for uncovering these effects among individuals who work completely remotely. In either case, these platforms offer the potential of large increases in the social richness and telepresence of users that can dramatically enhance their experience.

Second, we examined the mediating role of social exchange variables, as past findings have suggested this as a relevant theoretical framework to understand telecommuters [40]. However, there may be other mediating mechanisms and future work may consider simultaneously examining multiple mediating mechanisms to empirically determine the relevance of each. In particular, relationships with coworkers play an influential role in determining job outcomes, and incorporating both leader and coworker exchanges may be especially revealing. Moreover, leader monitoring of employees takes on increased importance in telecommuting and remote work environments, and the positive factors associated with social exchange may be negatively influenced by monitoring. Also, artificial intelligence offers the potential for future monitoring platforms to be smarter and less intrusive, incorporating coaching to increase positive managerial relationships. Additional work is needed to incorporate these and related issues as

platforms continue to develop.

Third, as the survey used in this study is cross-sectional, it is unclear how other organizational characteristics (including policies, corporate culture, and leadership) may enable (or impede) the effective deployment of telecommuting systems. The rapid and large-scale adoption of telecommuting systems across a wide variety of organizations as a result of COVID-19 provides an important context to study these organizational differences. In this regard, it may be that prior organizational experience with telecommuting, in conjunction with high levels of organizational IT capabilities, could provide a boost to organizations seeking even greater effectiveness. For example, it may be particularly interesting to examine how policies surrounding the use of telecommuting technologies before COVID-19 may have influenced the degree of success in adoption of these technologies during the pandemic. Incorporating the role of time, both from a conceptual and empirical perspective (see [118]), systematically incorporating the role of time will be critical to understanding how to effectively deploy telecommuting systems, especially as millions have been forced into remote work.

Fourth, we were unable to control for specific job characteristics. In particular, investigating telecommuting for IT-specific job roles, such as programmers or "road warriors" [119], or more nuanced examinations such as the degree of autonomy or interdependence in those roles, may be of particular interest to the IS community. Future work should also attempt to incorporate ways of characterizing daily activities of workers into models that enhance our understanding of telecommuting, system use, and job outcomes. Especially in light of the COVID-19 pandemic, different job characteristics models and a range of job outcomes including job stress, isolation, and exhaustion [120] are important to study [8].

Finally, although there have been some efforts to extend the study of geographic regions outside of the United States [121–123], our findings do not provide insights into how job outcomes of telecommuters may be influenced by national cultural norms. Future work should investigate ways in which telecommuting may be influenced by societal and cultural factors including those experienced by multinational organizations that transcend multiple national and political boundaries [124–126].

7. Conclusions

Telecommuting and remote work enabled by information technologies have an important and growing role in many organizations—and this has grown to unprecedented levels since the onset of the COVID-19 pandemic. This research furthers our understanding of potential limitations of the telecommuting experience and how technology can help to improve the telecommuting experience. Specifically, we found that software quality—incorporating, social presence and telepresence—along with the level of telecommuting are key levers by which management can facilitate positive outcomes of remote work on exchange relationships. Greater knowledge of critical elements necessary for success will enable organizations to adopt or increase the success of their telecommuting programs. We hope that this work, along with other work on telework, serves as critical building blocks for researchers and practitioners, as we combat the workplace disruptions caused by COVID-19.

Author statement

All authors contributed equally to this study, except for data collection, which was done by Dr. Kuruzovich and Dr. Paczkowski.

Appendix A. Scales

Telecommuting System Use (adapted from Golden & Veiga [33])

The questions below as about the telecommuting system used when working remotely. Please consider the telecommuting system as all the enabling technologies (hardware, software, and networking) that support you when telecommuting.

1 In an average or typical week, approximately how many hours are you using the telecommuting system? (hours per week)

Telepresence (adapted from Kim [97]; Slater et al. [51]; and 7-point Likert agreement scale

1 When I was using the telecommuting system… I felt like I was in a world that the system had created.
2 When I was using the telecommuting system… I felt like I was visiting another place.
3 When I signed into the telecommuting system… I felt like I had entered the system and left the "real world" behind.
4 When I was finished using the telecommuting system… I felt like I had to journey back to the "real world" around me.

Social presence (adapted from Short et al. [49]; 7-point scale)

Using the telecommuting system and interacting with others created a _____ environment for communication. (Four items with anchors of: *insensitive-sensitive*; *cold-warm*; *impersonal-personal*; and *unsociable-sociable*.)

Leader Member Exchange (LMX; Graen and Uhl-Bien [69]; 7-point scale, as noted)

1 How well does your leader understand your job problems and needs? *(Not a Bit or A Great Deal)*
2 How well does your leader recognize your potential? *(Not at All or Fully)*
3 I have enough confidence that my leader would defend and justify his/her decision if he/she were not present to do so? *(Strongly Disagree or Strongly Agree)*
4 How would you characterize your working relationship with your leader? *(Extremely Ineffective or Extremely Effective)*

Perceived Organizational Support (Eisenberger et al. [92]; 7-point Likert agreement scale)

1 My organization cares about my well-being.
2 My organization strongly considers my goals and values.
3 Help is available from my organization when I have a problem.
4 My organization is willing to help me if I need a special favor.

Job Satisfaction (O'Reilly and Caldwell 1981; 7-point Likert agreement scale)

1 Overall, I am satisfied with my job.

Organizational Commitment (O'Reilly and Chatman [101]; 7-point Likert agreement scale)

1 I am proud to tell others that I am part of this organization.
2 I talk about this organization to my friends, as a great organization to work for.
3 I feel a sense of "ownership" for this organization rather than just being an employee.

Job Performance (7-point scale, as noted)

1 On my last performance review, my supervisor had rated my overall job performance as… (Poor or Excellent)

Controls

1 (Hours Home) How many hours are spent working from your home? (hours per week)
2 (Hours Other) Some employees work away from their company office but not at home (e.g., at a client site, alternative work location besides the home, etc.). If this describes your work practice, approximately how many hours in a typical week are spent working this way? (hours per week)
3 (% Away) Considering your typical work week and the hours you generally work, what percentage is spent working from home rather than commuting to the office?
4 (Age) Please indicate your age (0 = <20; 1 = 20–30; 2 = 31–40; 3 = 41–50; 4 = 51–60; 5 = 61–70; and 6 = >70)
5 (Gender) Please indicate your gender. (0 = male and 1 = female)
6 (Employees) How many people are there in your organization?
7 (Experience) How many years of work experience do you have?
8 (Years Telecommuting) How many years have you been telecommuting? (years)

Appendix B. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.im.2021.103431.

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