



No. 016/2020/MAN

Does Information Technology Usage Substitute or Complement Formal
Control in Digital Platform Relationships?

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May 2020

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Abstract: Regarding information technology usage as an alternative control mechanism, this study attempts to investigate the role of information technology usage, formal contracts, and their interaction on platform participants firms' financial performance in a digital platform relationship setting. Using data collected from 384 platform participant-platform builder relationships from China's two largest digital product platforms, hierarchical regression is used to investigate the direct effects of formal contracts and information technology usage as well as the moderating effects of technology on formal contracts-financial performance link. The results show that contract completeness and information technology usage can independently improve financial performance, while contract enforcement has an inverted U-shape effect on financial performance. Furthermore, information technology usage amplifies the positive effect of contract completeness but not of contract enforcement on financial performance. This study advances the literature in partnership control by revealing the role of information technology usage as a control mechanism. Simultaneously, this study enriches the research on technology by offering an integrated perspective concerning how technology benefits business partnerships. Finally, this study extends transaction cost theory by demonstrating that different dimensions of contracts have different effects on governing interfirm exchange relationships.

Keywords: control; digital platform; information technology usage; contract completeness; contract enforcement; financial performance

Managerial relevance statement: The findings offer helpful managerial implications for managers regarding partnership control in the digital platform setting. First, managers are encouraged to implement information technologies to govern platform partnership. By facilitating transparency, information technology can promote cooperation efficiency and foster financial performance. Thus, managers should recognize that information technology usage can play as an alternative and cost saving control mechanism in the digital platform setting. Second, the empirical results suggest that different dimensions of formal contracts have distinct effects on financial performance. Given the positive linear relationships between contract completeness and participants' financial performance, managers from both platform builder and participant can agree to design detailed contracts. Furthermore, managers can simultaneously use information technology to amplify the positive effect of contract completeness. Yet when contract enforcement is preferred, the key issue for managers from platform builders is to decide the optimum extent of contract enforcement. Too little contract enforcement is not enough to exert a deterrence effect on platform participants, while too much may harm platform participants' interests which may reduce the participants' willingness to cooperate.

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I. INTRODUCTION

Control, aiming at restraining opportunism and improving performance, is vital to various interfirm relationships, such as supply chains, marketing channels, and alliances [1-3]. By virtue of either economic incentives or social disciplines, control is achieved by influencing the controlee to behave in a way that the controller wants [1]. However, contrary to the common wisdom, the recent popular firms of digital platform builders seem to have established and maintained good partnerships with platform participant firms without much use of formal control [4-5]. For example, Tencent cooperates with its millions of independent developers of software application or digital game via its open platform. Tencent's contract with each of these developers only addresses the legitimacy of the content of the applications or games, without much details on cooperation procedure or behavior monitoring. One possible reason for this change may lie in the widespread usage of information technology in the operations of digital platforms.

In platform builder-platform participant collaborations, nearly every aspect, such as negotiation, products/services posting, behavior supervision, and benefits distribution, is facilitated by information technology [5]. Cooperation procedures and interfaces are clearly defined by technology specifications. The effects of technology in business partnerships are mainly acknowledged by two logics in previous literature. On one hand, the technology-based view asserts that technology coordinates firms to interact more effectively

and efficiently with each other via advanced information storage and transfer techniques [6-8]. On the other hand, the ‘subsystems decoupling’ perspective posits that technology safeguards partners’ interests by timely regulating firm behaviors and noticing opportunism via strictly codified technical specifications and interfaces [4]. All told, information technology usage serves ‘coordination’ and ‘safeguard’ functions, which are the two main functions of formal control [9]. An interesting research question thus arises: can information technology usage substitute or complement formal control in digital platform relationships in promoting firm financial performance?

Thus, using data from Chinese digital platform builder–platform participant relationships, this study proposes an integrated model to investigate the direct effect and interactions of information technology usage and formal contract control on platform participant firms’ financial performance. In doing so, we treat formal contract control as a two-dimensional construct involving contract completeness and contract enforcement to distinguish the ‘coordination’ and ‘safeguard’ functions based on previous literature. The former focuses on the terms and clauses included in the contractual agreement and can be regarded as an *ex ante* governance [10]; the latter insists on the application and execution of the formal agreements in daily interfirm operations and can be considered as an *ex post* governance [11].

This study aims to provide new insight into how control is achieved in digital platforms. We argue that if information technology usage is integral to the effective coordination and safeguard of platform cooperation, then it should substitute or complement formal control to some extent. In contrast to formal contract, which induces high costs in *ax ante* negotiation,

whole process monitoring, and ex post mal-adaption, information technology usage provides a less costly and equal effective control mechanism. Managers just need to well devise and implement operation facilitating technical system. The aim of control is achieved naturally. As such, this study extends the existing framework of interfirm control mechanisms [1, 9, 12] and redirects prior efforts to technology in business partnerships [4-5]. The conceptual model is depicted in Figure 1.

II. THEORETICAL BACKGROUND

A. Formal contract control

Contracts, defined as the agreements between exchange parties [1], is a universal formal control mechanism to regulate interfirm relationships and have various forms, such as informal promises or formalized agreements, incomplete or complete task execution [13]. For example, a formal contract provides a legally binding institutional framework in which partners' rights, duties, and responsibilities are codified and the goals and polices underlying their exchange relationships are specified [14]. Accordingly, control is achieved through monitoring and incentive-based systems [1].

As the prominent theoretical lens on the roles of contract in interfirm relationships, transaction cost economics mainly emphasizes the safeguarding functions of contracts [13, 15]. Specifically, since firms are always "bounded rationally" and "self-interest pursuing," they are likely to behave opportunistically in market transactions where internal hierarchical authority is absent, resulting in the need for alternative governance mechanisms such as formal contract [16]. Other theoretical perspectives (i.e. relational and firm capabilities) contend that the main purpose of the use of contracts is to coordinate exchange relationships,

thus, contracts not only serve as a means of safeguarding but also function as the approaches to coordination and adaptation [13]. In detail, through various penalties for noncompliance, contracts can safeguard each partner's interests; by allocating the exchange partner's task, roles, and obligations, and clear provisions for the monitoring, process, contracts can foster coordination between exchange partners [17]; by incorporating contingency planning, contracts can help exchange partners adapt to exogenous disturbances.

One dimension of formal contract is completeness which concerns how specific and detailed contractual terms are. Because it is impossible to predict all future states, hazards also trigger clauses that help to address unexpected events [18]. Contract completeness also includes contingency adaptability, which involves how to respond to future problems, conflicts, and contingencies [14]. From a theoretical perspective, most studies argue that contract completeness can improve financial performance (i.e., sales volume, profit, and return on investments) by specifying roles and obligations and by facilitating adjustment. However, empirical studies have offered mixed results. For example, Liu et al. [1], Mesquita and Brush [19], and Ferguson et al. [20] found that contract completeness can foster financial performance, while Li et al. [21] and Rhee et al. [22] found that contract completeness cannot.

However, some other scholars note that no matter how complete a contract is, if the relevant parties do not apply it to their daily operations, it remains useless [23]; as a result they insist that the effectiveness of a contract depends to a large extent on sound enforcement practices. Contract enforcement, the second dimension of contract, defined as the severity of the platform builder's disciplinary response to platform participants' violation of the

contractual agreement [23], is the action aimed at remedying problems resulting from violations of contractual agreements [11].

B. Technology usage in interfirm partnership

Technology, especially information technology, plays an increasing critical role in interfirm relationships, such as supply chain, buyer-supplier, and digital platforms [5, 24-26]. However, systematic theoretical and empirical investigation concerning its effectiveness in business partnerships is still scarce. Originated as an information processing tool, the traditional technology-based view focuses on technology's ability in increasing firms' ease of information storage and transfer, connection to external resources, and the effectiveness of interaction with partners [7, 26-27]. In the platform setting, technology facilitates communication, accelerates resource matching, simplifies cooperation procedure, and reduces human involvement in the relationship between a platform builder and its participants [27-28]. By authorizing participants to access and utilize a variety of information, resources, and capabilities on the platform, technology helps participants to coordinate various interfaces and fulfil their operation processes autonomously [29-30]. As a result, a 'coordination' function of technology usage is thus achieved. As indicated in Zhang et al.'s [31] research, positive effects are found between technology usage and coordination in both operation and strategy. Similarly, Benitez et al.'s [32] research indicates that technology usage can facilitate coordination between employees by providing accurate real-time information and improving knowledge exchange.

The 'subsystems decoupling' logic provides another perspective on how technology impacts business partnerships. According to this logic, any complex system is composed of

many distinct but interdependent subsystems [33]. It is the interactions among those subsystems that support the operation of the whole. Reflected in business partnerships, interfirm collaboration (complex system) is achieved by the well coupling of various business activities (subsystems) across intrafirm function units and interfirm boundaries [4, 34]. The contree of the partnership needs to utilize and regulate these coupling behaviors to accomplish tasks and enhance performance [4]. Technology helps here in that, in technology-dominant interfirm partnerships such as the digital platforms, cooperation procedures and interfaces are clearly defined by technology specifications [35]. The only way for behaviors or processes to be recognized and executed by the transaction system is to strictly comply with the codified technical specifications. Firms have little room to shirk their obligations. Violating behaviors are easily noticed by the technical system and the need for the contree to supervise and monitor the controller's behaviors is thus reduced. Per this notion, technology usage fulfils the role of 'safeguard' in interfirm partnerships.

In addition to the above technique and system perspectives, more recent studies explain the 'coordination' and 'safeguard' effects of technology in business partnerships from a relational view. By codifying operation procedure, interface, and benefit distribution specifications, technology increases the transparency of collaboration clauses to all parties involved and ensure that such clauses will be executed in a consistent way [5]. A controller thus can easily know whether it is treated equally as compared with other controllers by the contree, how its duties are required, and how much benefit it can get from the partnership. Such transparency and consistency guarantees help firms feel confident about the partnership, willing to consciously resist opportunistic behaviour and conduct knowledge sharing or

investment within the partnership [36-37]. Accordingly, participants will be more likely to fulfil their obligations; and thus, technology usage serves as coordination and safeguard mechanisms.

Regarding the widespread information technology usage in digital platforms, the above ‘coordination’ and ‘safeguard’ functions of technology are likely to co-exist and jointly aid platform operations. However, relevant investigations remain lacking. By proposing an integrated model, we simultaneously explore how the ‘coordination’ and ‘safeguard’ functions of technology influence formal contract control in fostering firm financial performance, and how the ‘coordination’ and ‘safeguard’ function of technology is transferred to favourable firm financial performance. Such a comprehensive understanding may better explain why platform builders control their partnerships with platform participants with less formal contract control.

III. HYPOTHESES

A. Contract control and financial performance

In the platform setting, a complete contract outlines the objectives of the platform, specifies the rights and obligations of each party, and defines the rules and procedures of platform operations [13, 14, 38]. Partners’ behaviours become explicit and transparent. Violating behaviours is easily noticed; thus, incentives for opportunism and needs for monitoring both decline. A complete contract also clarifies how future contingencies and disputes will be handled, which helps to reduce difficulties in conflict resolution and maladaptation. According to transaction cost theory, less opportunism, less monitoring, and easier maladaptation all reduce transaction costs and accordingly boost the financial performance of

the platform participant [16, 39].

Clearly and completely articulated clauses indicate that platform builder and participants have reached a mutual understanding of each other's roles, obligations, and responsibilities, which limits the domain of firm behaviours and narrows the operational risks to which an exchange may be exposed [38, 39]. Serving as the foundation of cooperation, a complete contract can guide partners' actions and leads firms to believe that their partners are applying sincere efforts to fulfil their obligations [13, 40]. Thus, firms will be more likely to share resources, make specific investments, and conduct integration to exploit market opportunities [41]. These activities ensure the transfer and utilization of important internal organizational resources and capabilities across organizational boundaries [42]. Therefore, such collaborative behaviour promotes better financial performance, such as higher sales volume, high profits, and more customers. Taken together, we suggest:

H1: Contract completeness will have a positive effect on platform participants' financial performance in platform collaboration.

Unlike contract completeness, we suggest an inverted U-shape effect between contract enforcement and financial performance in a platform based on the following arguments. As the severity of contract enforcement increases from low to moderately high, exchange partners gain a greater awareness of their expected roles and actions in the relationship [10] and are aware that both platform building and platform operation are constrained by the contract [23]. By emphasizing that any contract-violating behaviour will induce serious sanctions from the other side, contract enforcement sends a signal that each partner should pay attention to their assigned duties and responsibilities and consciously avoid opportunism or conflicts [11, 14]. Each partner's awareness of its own responsibility and limits of activity

reduces transaction costs and promotes financial performance. Similarly, in the presence of deterrence against economic sanctions, each party must fulfil its assigned duties. A firm does not need to take a “wait and see” attitude in an exchange relationship, waiting to perform its obligations until its partner has already obeyed certain rules. Thus, contract enforcement enhances partners’ confidence in its counterparts and self-awareness in cooperation [43]. Having more self-discipline, each side will take its own duties and responsibilities seriously and be eager to fulfil them in a timely and qualified manner, which in turn enhances financial performance.

Although contract enforcement enhances financial performance, beyond a certain level, the positive effect may fade. When the extent of contract enforcement moves from moderately high to particularly high, firms’ behaviours are strictly constrained and monitored by the contract terms. To avoid punishment for breaching contracts carelessly, firms may become sensitive and cautious in their behaviours [11] and prefer to behave in accordance with established procedures, transferring information and making decisions hierarchically. Such an attitude and behaviour harms flexibility and result in rigid organizational structure and low responsiveness to the market [2, 44]. Firms are likely to miss new market opportunities and be outflanked by competitors and are thus unlikely to obtain high profit margins. Moreover, fixed operations, information transfer, and decision-making processes signal a lack of trust between exchange partners [2], undermine the intention to cooperation in the future, and will occupy a large amount of organizational resources in manpower, capital, and time, leading to an increase in transaction costs. Per this notion, exorbitant contract enforcement may harm financial performance. Thus, there is a threshold extent of

contract enforcement. Below the threshold, financial performance will increase along with increased contract enforcement, while above the threshold, financial performance will decrease when contract enforcement continually increases. As a result, we postulate:

H2: Contract enforcement will have an inverted U-shape effect on platform participants' financial performance in platform collaboration.

B. Information Technology usage and financial performance

In the presence of information technology usage, the cooperation process between platform participant and platform builder is strictly codified and constrained by clear technical procedures and interfaces [5]. Transaction details become transparent to each side and partners know exactly how interfirm interactions, decision making, and conflict resolution will be executed. Thus, each participant not only know its own obligations but also understand partner's responsibilities, which promotes their cooperation and fosters better financial performance.

In addition, due to information technology usage, a platform builder cooperates with different participants using consistent technical standards and interfaces. Participants are treated as equals by the platform. Such transparency and fairness encourage participants' perception that they are being treated fairly by the platform compared to other participants or the overall market [45]. Then, they will believe that their cooperation outcomes are easy to predict and that their interests are protected by policies. Consequently, they will be willing to communicate, share information, and invest to continue the relationship [36]. Communication deepens firms' mutual understanding, increases their confidence in cooperation, and encourages firms to expect joint goals, norms and reciprocity; this in turn fosters financial performance [46]. Specific investment provides firms with complementary resources to

nurture their unique capabilities and upgrade the efficiency of their core functions [42], which contributes to firms' competitiveness and ultimately benefits financial performance [36, 45]. Moreover, the mutual recognition and transparent procedures guarantee both sides fair opportunities to express their expectations and concerns, and each side's pursuits and interests can be accommodated [37], which promotes to fulfil their obligations and then enhances financial performance. Thus, we posit the following:

H3: Information technology usage will have a positive effect on platform participant firms' financial performance.

C. Interaction between information technology usage and contract control

Information technology usage and contract completeness

According to the technology-based view and the transaction cost economy, we posit that the interaction of information technology usage and contract completeness exerts a positive effect on platform participants' financial performance. First, contract completeness flushes out both the explicit clauses and unspoken assumptions about each partner's rights, duties and responsibilities in a partnership [14]. Its effectiveness largely depends on to what extent the controlees can comply with it. Information technology usage helps to clearly codify those partners' duties, responsibilities, exchange interfaces and procedures at a technical level, effectively avoiding human intervention, which provides the controller more power to portray a coordination framework and ensure that certain organizational routines are implemented and partners' tasks are accomplished in the pre-designed way [5]. Thus, information technology usage encourages exchange partners to take contracts seriously and to abide by contractual clauses; in turn, the effectiveness of contract completeness will be enhanced [4].

Second, advanced technologies facilitate improved interfirm communications and

simplified cooperation procedures between platform and participants, enabling them to interact more effectively and efficiently [27]. Such rapid and thorough communication enhances each partner's understanding of contractual terms and resolves ambiguity or conflicts surrounding duties and rights allocation. Advanced technical facilities and better awareness about contractual terms in turn improves firms' efficiency in fulfilling assigned duties and cooperation procedures [47], which also enhance the effectiveness of terms specified in a complete contract. In summary:

H4: Information technology usage will have a positive moderating effect on the relationship between contract completeness and platform participant firms' financial performance in platform collaboration.

Information technology usage and contract enforcement

In contrast, we suggest that the optimal level of contract enforcement is likely to decrease when information technology usage is high rather than low. The main purpose of contract enforcement is to ensure that each party's behaviors are restrained by the specific clauses of a contract [11-12]. Its effectiveness is achieved by rewarding compliance behaviors and punishing violating behaviors of the controlee. Information technology usage embeds specific contractual requirements in technical routines and interfirm/functional interfaces [7, 27]. Only by completely complying with certain criteria and procedures can a firm conduct and remain in business [5]. Thus, information technology usage guarantees the effectiveness of contract enforcement in a more autonomous manner without much enforcement from the platform builder to the participants. Likewise, information technology usage also lowers the need for monitoring and the threat of opportunism, as rigid technical programs make it easier to detect and punish violating behaviors. Once one side's online procedures are stopped at one step due to a violation, no further steps can be taken. As a result, partners' incentives to

behave opportunistically are reduced, and they are more attentive to fulfilling their assigned duties and responsibilities. Hence the necessity of maintaining a high level of contract enforcement is reduced.

Moreover, information technology usage also eliminates the possibility of personal interactions, which hinder the building of personal ties between platform builder and platform participants [5]. Although this may result in rigid organizational structure, it successfully avoids shirking by personal favors or reciprocity in fulfilling contractual terms [48]. In this way, contract clauses can be enforced more strictly and completely. Thus, for a specific level of financial performance, due to the increased efficiency of contract enforcement, the extent of contract enforcement need not remain as high as it was previously. The foregoing arguments lead to:

H5: Information technology usage will have a negative moderating effect on the relationship between contract enforcement and platform participant firms' financial performance in platform collaboration.

IV. METHOD

A. Data collection

The proposed model is tested using data collected from participants on two of the largest platforms in China. China is now the world's largest online retail market with the most online consumers. The ever-growing e-market has propelled the emergence of many platforms, such as Taobao, Tencent, China Mobile, Jing Dong, etc. Fierce competition forces platforms to lay great emphasis on partnership control, to increase their efficiency and performance. This makes China an ideal context for examining control issues in platform relationships. To ensure consistency, we choose the two largest application platforms for PC and mobile

phones, Tencent and China Mobile, as the data sources for this study. Tencent has billions of users all over the world, on both PC and mobile. Tencent's open platform is used to develop creative social games, utilities, and applications for its customers. China Mobile is the largest communications business operator in China. Its mobile market is a mobile app download platform its 700 million customers. Due to the huge number of customers and diversified customer preferences, these two platforms cannot satisfy their customers using just their own development capability. They have to cooperate with numerous platform participants (mobile software developers) to get products.

To learn about the platform context and relevant control issues, we conducted field interviews with eight managers from Tencent, China Mobile, and their participants, asking them several open-ended questions concerning the relationships between participants and builders, and the roles of contracts and technology. Our field interviews revealed that the effects of contract completeness and contract enforcement change a lot on platforms due to the emergence of technology, which enables us to examine control issues for platform. All the questionnaire items were borrowed from past research. Since the questionnaire was administered in China, the questionnaire was first developed in English, translated into Chinese, and then translated back to English to ensure accuracy.

To ensure content validity, we conducted five in-depth discussions with two professional scholars and three industry operations managers to verify the relevance and accuracy of the measures. To enhance clarity, we reworded some of the items based on their responses. Next, a pilot study was conducted with 17 volunteers from "Tencent developer (Beijing) Salon" and "China Mobile Global Developers Conference". They completed the questionnaire and

provided oral feedback on the design and wording of the survey. The questionnaire was then finalized according to this feedback.

Tencent and China Mobile supported formal data collection the process. A sample of 200 platform participants was randomly selected from three tiers¹ (regular, semi-close, and close based on their value contribution to the platform) of both Tencent and China Mobile, with a total of 1200 samples. In each sample, the operations manager in charge of the collaboration process served as the key informant. Managers were contacted by an email sent from Tencent and China Mobile on our behalf via their daily communication channels. The questionnaires were filled in anonymously. To encourage participation, a cover letter with a description of the research intent, a confidential agreement, and a willingness to offer a summary report was offered. After eliminating surveys with missing data, we obtained 384 complete responses, with an effective response rate of 32.0% in three weeks. A comparison between the early and late responding samples indicates no significant differences in firm characteristics, eliminating concerns over non-response bias in our study.

B. Measurement reliability and validity

All latent variables are operationalized through multi-item scales and measured on a 7-point Likert scale ranging between “strongly disagree” and “strongly agree” (see Table 1). Four measures for contract completeness were adapted from Jap and Ganesan [49], Liu et al. [1], Li et al. [21]. Another four items measuring contract enforcement were adapted from Antia and Frazier [23]. Four items from Narasimhan and Kim [50] and Geyskens and Steenkamp [51] were used to capture financial performance, which focuses on platform participants’

¹ The tier of a participant is determined by the comprehensive evaluation of its cooperation time span with the online market, quantity of online products, online sales volume, customer feedbacks, etc. Participants of different tiers are given different online privileges and accordingly the scope and extent of technology usage are diversified among different tiers.

sales volume, profit, return on investment and the number of customers. As for information technology usage, we began with De et al.'s [52] description of technology usage in online sales and Tiwana's [4] technology modularity scales. We refined the wording and finalized five items based on the suggestions and feedback from interviews with both market builders and participants.

Given that the dependent variable in this model will be influenced by other factors, we included another six constructs as control variables. First, previous studies claim the importance of relationship duration in interfirm relationships. The longer the relationship length, the more familiar the exchange partners; exchange partners can then cooperate with each other more easily, which in turn promotes financial performance [53]. Thus, relationship duration (the lifespan of cooperation between platform and participant) is added as a control variable. Second, we control firm size (the number of full-time employees at the time of conducting the survey) or sales volume (total sales in one year). Firm size and sales volume represent participants' dependence and will impact the cooperation between exchange partners [54]. Third, product type and firm ownership are included since this implies the transaction complexity and influences the outcomes of interfirm relationships. Lastly, relational norms, considered the most recognized relational governance mechanism [44], are also included to avoid their potential influence on financial performance.

The high Cronbach's alpha values (all > 0.91) verified the internal reliability of all constructs (see Table 1). Because all the measurements were borrowed from prior studies and adapted after feedback from interviews, content validity was ensured. An exploratory factor analysis was conducted on all items using principal component analysis with a varimax

rotation. The results were successful, with five eigenvalues larger than 1, and exclude the possibility of cross-loading. We ran confirmatory factor analysis using AMOS 24.0 for the overall five-factor model with all the items included. The results show a good overall construct structure fit ($\chi^2/df = 2.09$, CFI = 0.98, GFI = 0.93, NFI = 0.96, IFI = 0.98, and RMSEA = 0.05). The composition values are well above the usual 0.70 benchmark (all > 0.91) and the average variance extracted values are all higher than the 0.50 cut off (all > 0.71). Thus, convergent validity is satisfactorily demonstrated. Regarding discriminant validity, we first assessed it using this rule: the squared correlation between each pair of constructs is less than the AVE value for each construct. Next, we compared the fit between the one-factor and two-factor CFA models, as suggested by Dabholkar and Bagozzi [55]. The results of the analysis showed that the chi-square difference tests for each pair of constructs (with 1 degree of freedom) were statistically significant ($\Delta\chi^2 (1) > 3.84$), demonstrating satisfactory discriminant validity. We then checked the 95% confidence interval of the correlations between two randomly selected factors and found that 1.0 did not exist at any interval, also suggesting good discriminant validity.

As data for both dependent and independent variables were collected from a single respondent, we employed multiple techniques to test the threat of common method bias. First, we ran the Harman's one-factor model. No single factor accounted for most of the variance. Next, we compared the fit index of two measurement models. One model included traits only, while the other included traits and a method factor [56]. The fit of the method factor model was only marginally better than the fit of the traits model (CFI by 0.00, GFI by 0.01, RMSEA by 0.005). Then, we followed Podsakoff et al. [57] and added a common method factor to the

structural model, which did not substantially modify the estimates and the significance of each path, which indicates that the common method factor only accounts for a small variance. Thus, common method variance bias should not be of major concern in this study. Table 2 presents the descriptive statistics and correlations among all constructs used in this study.

Insert Table 1 and 2 about here

C. Analysis and results

To mitigate the potential threat of multicollinearity among the interaction terms and other variables in the regression model, all independent variables are mean-centred and hierarchical regression analysis is used to test hypotheses. H1 and H2 examine the direct effects of contract completeness and contract enforcement on financial performance respectively. As shown in Model 2 of Table 3, contract completeness has significant positive effects on financial performance ($\beta=0.276$, $p<0.001$), supporting H1. For contract enforcement, its direct effect on financial performance is not significant ($\beta=-0.056$, $p>0.05$), while its squared term exerts a significant negative effect on financial performance ($\beta=-0.095$, $p<0.05$), representing an inverted U-shape effect. Thus, H2 is also supported.

H3 concerns the direct effect of information technology usage on platform participant firms' financial performance. The positive significant effect ($\beta=0.207$, $p<0.01$) well support H3.

H4 and H5 address the interaction effects of information technology usage and contract control on financial performance. As Model 3 in Table 3 show, the interaction term $CC \times ITU$ has significant positive effects on financial performance ($\beta=0.217$, $p<0.05$), which lend support to H4. To better understand this moderation effect, we plot the moderation of

information technology usage on contract completeness. As shown in Figure 2, the positive relationship between contract completeness and financial performance becomes stronger when information technology usage is higher. While, the effect of the interaction term $CU^2 \times ITU$ on financial performance is not significant. Accordingly, H5 is not supported. We further divided the sample into two groups based on the median value of contract enforcement and then test the moderation effects in the two groups. Below the threshold, information technology usage significantly and negatively moderates the relationship between contract enforcement and financial performance. While, after the threshold, the moderation effect of information technology usage is non-significant. Since the interaction effects from below the threshold and after the threshold are different, the total interaction effect is non-significant which validate the result of H5.

Insert Table 3 and Figure 2 about Here

V. DISCUSSION AND CONCLUSION

The emergence of digital platforms and the widespread use of technology in facilitating platform operations are likely to induce changes in relationship management between partners. This study investigates this issue using an empirical approach to examine the role of information technology usage on platform participants' financial performance and its influences on the effectiveness of formal control, in terms of both contract completeness and contract enforcement in the Chinese digital platform setting. The results show that information technology usage not only directly contributes to platform participants' financial performance, but also influences the effectiveness of formal contract. Specifically,

information technology usage is a perfect complement of contract completeness. While, the substitute effect of information technology usage on contract enforcement is not significant.

A. Theoretical implications

Our findings contribute to the current literature in the following ways. First, our study advanced the literature in partnership control by asserting information technology usage as an alternative control mechanism in digital platforms. In existing literature, control in interfirm relationships is typically achieved by either formal contract or corresponding relational endeavors [1, 9, 12]. Although it is widely noticed that controllers in platform operations are increasingly reducing the use of formal control in their partnerships with controlees, theoretical and empirical verifications are still lacking. To answer this call, we explored both the direct effect and interactions of information technology usage and formal contract control on platform participant firms' financial performance. The empirical findings show that information technology usage is, both individually and interpedently with contract completeness, positively related to platform participants' financial performance. However, the effect of the interaction between information technology usage and overall contract enforcement on platform participants' financial performance is not significant. These results suggest that information technology usage can contribute to platform participants' financial performance, enhance the effectiveness of control completeness but does not lower the ability of contract enforcement in impacting platform participants' financial performance. As such, information technology usage can well serve a low-cost and high-performance control mechanism in the digital platform setting, enriching the existing framework of control mechanisms.

Second, this study enriches the technology study by providing an integrated perspective concerning how technology benefits business partnerships. Great benefits in practice notwithstanding, associated theoretical and empirical explanations regarding the effects of technology in business partnerships are relatively lag and disperse [7, 24, 25, 47]. By adding the lens of interfirm partnership control, this study theoretically and empirically proposes that information technology usage contributes to firm performance by ‘coordinating’ partner cooperative behaviors (i.e. H3 and H4 is supported), and ‘safeguarding’ for benefits and against opportunism (i.e. H3 is supported, and in the subsample analysis, H5 is supported when contract enforcement is under the median value). Such a perspective well transfers technology from an information processing tool into a control mechanism that is an important part of firm strategy and partnership development.

The third contribution of our study derives from the results that different dimensions of formal contract control contribute to firm financial performance differently, enriching transaction costs theory and corresponding control literature. Although some recent study proposes the distinction between ex ante contract completeness and ex post enforcement of contract [12], most previous studies, which generally see formal contract control as a unidimensional construct [1, 19, 21, 22]. Our study divides contract control into two sub-dimensions and finds that not all sub-dimensions always benefit firm financial performance (see H1-2). Yet our findings suggest that although contract completeness contributes to financial performance, contract enforcement exerts an inverted U-shape effect on financial performance. This finding cautions firms to pay significant attention to the extent of contract enforcement. Too much contract enforcement may result in rigid organizational

structure and low responsiveness, which may in turn harm financial performance. Determining a proper level of contract enforcement is thus critical to the success of firm financial performance. Therefore, our findings extend transaction cost theory and confirm to recent calls that different dimensions of contract control have different control effects on interfirm exchange relationships in platforms [12].

B. Managerial Implications

Our findings also provide important implications for managers regarding partnership control in the digital platform setting. First, the positive effects of information technology usage and its interaction with contract completeness on platform participants' financial performance suggest managers that when implementing platform partnership control, they are encouraged to use information technologies. The increased transparency and efficiency of cooperation procedures facilitated by information technology not only give the controlees confidence about the controllers' justice and cooperation sincere which induce higher compliance, but also save costs for controllers in process monitoring. Although the substitution effect of information technology usage on contract enforcement is not supported in the whole sample, the significant negative interaction effect in the subsample implies that when the need of contract enforcement is not high (<median value), information technology usage can indeed exert similar enforcement effect and replace the role of contract enforcement. These all together suggest information technology usage as an alternative and cost saving control mechanism in the digital platform setting.

Our results also suggest managers that business partnerships must deploy certain control mechanisms to enhance performance and guard against potential risks. Our study divides

formal contract control into two dimensions and highlights their diverse effects in platform participants' financial performance. Given the positive linear relationships between contract completeness and participants' financial performance, managers from both platform builder and participant can agree to design detailed contracts. Yet when contract enforcement is preferred, the key issue for managers from platform builders is to decide the optimum extent of contract enforcement. Too little contract enforcement is not enough to exert a deterrence effect on platform participants, while too much may harm platform participants' interests which may reduce the participants' willingness to cooperate.

C. Limitations and Further Research

Our study is an initial effort to examine control issues in the emerging digital platform setting. Further research is thus necessary. First, we only use the cross-sectional data from participants in two platforms to test our conceptual model and hypotheses, which may limit the generalizability of our findings. Although our conclusions may not be generalizable to all platform transactions, our key assumptions, theoretical model, and empirical findings are likely applicable to mobile apps and game platforms, as the two platforms in our study are two of the largest ones in the current Chinese market. Future studies may employ a longitudinal design and collect panel data from different kinds of platforms to validate or enrich the model.

Two, we focus only on contractual control and neglect relational control (treated only as control variables). Previous research maintains the critical role of relational control in coordinating exchange partners' behaviour and promoting collaborative effectiveness and efficiency [1, 38, 58]. Thus, future research could explore the direct effect of relational

control and the interaction effect of contractual and relational control in a platform transaction.

Finally, this study focuses on the effects of information technology usage, but does not analyse the determinants of information technology usage. Given that information technology usage is obvious in the digital platform setting, future studies may investigate which characteristics of platform transactions facilitate the implementation of technology. Understanding the formation conditions of information technology usage would provide managers with clear guidelines for making arrangements and allocating resources for technology implementation, and for better managing information technology usage after implementation.

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Table 1
Construct Reliability and Validity

Construct	Cronbach α	Factor Loading	CR	AVE
Contract completeness	0.910		0.717	0.910
CC1: We and the platform define the overall cooperation objectives and key performance indicators in the contract.		0.899		
CC2: We and the platform emphasize specifying every transaction detail in the contract.		0.746		
CC3: We and the platform emphasize specifying what will happen in the case of events occurring that were not planned in the contract.		0.829		
CC4: The respective rights and responsibilities of us and the platform are clearly specified in the contract.		0.903		
Contract enforcement	0.930		0.731	0.915
CU1: If we break contract terms, the platform will take tough action in response.		0.933		
CU2: If we break contract terms, the platform will severely punish us.		0.948		
CU3: If we break contract terms, the platform will warn us to change our behavior; otherwise they will terminate the cooperative relationship with us.		0.789		
CU4: If we break contract terms, the platform will take legal action against us.		0.729		
Information technology usage	0.920		0.738	0.934
ITU1: The platform evaluates our application and qualification through the information technology system.		0.901		
ITU2: The platform's testing of our products is accomplished by information technology.		0.808		
ITU3: The on-line process of our products onto this platform is accomplished by information technology.		0.874		
ITU4: Our daily communication with the platform is accomplished by information technology.		0.879		
TU5: Support and services from the platform are provided through information technology channels.		0.829		
Financial performance	0.918		0.724	0.913
FP1: More sales volume		0.796		
FP2: Higher profit		0.858		
FP3: Higher rate of return on investment		0.873		
FP4: More customers		0.874		

Table 1 (continued)
Construct Reliability and Validity

Construct	Cronbach α	Factor Loading	CR	AVE
Relational norms	0.873		0.728	0.914
RN1: We face difficulties and challenges together with the platform.		0.833		
RN2: We and the platform believe that we should provide each other the information they need.		0.885		
RN3: Our relationship with the platform is based on mutual trust and common interests.		0.851		
RN4: When conflicts emerge, both sides are willing to make changes to adapt to each other.		0.843		
Relationship duration: We have maintained _____ years of cooperation with the platform.				
Firm size: 1) less than 10; 2) 11–20; 3) 21–50; 4) 51–100; 5) more than 100				
Sales volume: 1) less than 1 million; 2) 1–5 million; 3) 5–20 million; 4) 20–50 million; 5) more than 50 million				
Product type: 1) games; 2) applications; 3) multiple				
Firm ownership: 1) state-owned; 2) Sino-foreign joint venture; 3) wholly foreign owned enterprise; 4) privately-owned; 5) individual ownership				

Note: AVE = average variance extracted; CR = composite reliability

Table 2
Descriptive Statistics and Pearson's Correlation Matrix (N = 384)

	Mean	S.D	1	2	4	5	6	7	8	9	10	11
Contract completeness	5.056	1.144	1									
Contract enforcement	5.145	1.143	0.727**	1								
Information technology usage	5.866	1.086	0.318**	0.321**	1							
Financial performance	4.974	1.211	0.376**	0.264**	0.399**	1						
Relationship duration	1.738	1.344	0.130**	0.115**	0.085	0.001	1					
Firm size	3.497	1.335	0.143**	0.119**	0.099	-0.012	0.309**	1				
Sales volume	3.089	1.388	0.007	0.056	0.021	-0.089	0.252**	0.767**	1			
Product type	1.628	0.759	0.103**	0.088	0.046	-0.026	0.199**	0.149**	0.020	1		
Firm ownership	3.796	0.760	0.040	0.050	-0.038	0.058	-0.276**	-0.209**	-0.213**	-0.142**	1	
Relational norms	5.954	0.073	0.466**	0.365**	0.520**	0.416**	-0.070	0.005	0.007	-0.133**	0.075	1

Table 3
Hypotheses Testing: Regression Results of Moderation (N = 384)

Variable	Financial performance		
	Model 1	Model 2	Model 3
Controls			
Firm size	0.124 ⁺	0.089	0.093
Relationship duration	0.047	0.017	0.016
Sales volume	-0.194**	-0.168*	-0.172*
Product type	0.009	0.012	0.013
Firm ownership	0.025	0.006	0.001
Relational norms	0.419***	0.161*	0.165*
Main effects			
Contract completeness		0.276***	0.299***
Contract enforcement		-0.056	-0.043
Contract enforcement ²		-0.095*	-0.161*
Information technology usage		0.207***	0.228***
Moderation			
Contract completeness × Information technology usage			0.217*
Contract enforcement × Information technology usage			-0.202 ⁺
Contract enforcement ² × Information technology usage			-0.084
Model fit			
F-value	14.857***	13.181	10.671
R ²	0.191	0.261	0.273
Adjusted R ²	0.178	0.241	0.247

Note: The coefficients in the model are all standardized values.

+ p<0.1; * p<0.05; ** p<0.01; *** p<0.001.

Figure 1
Conceptual model

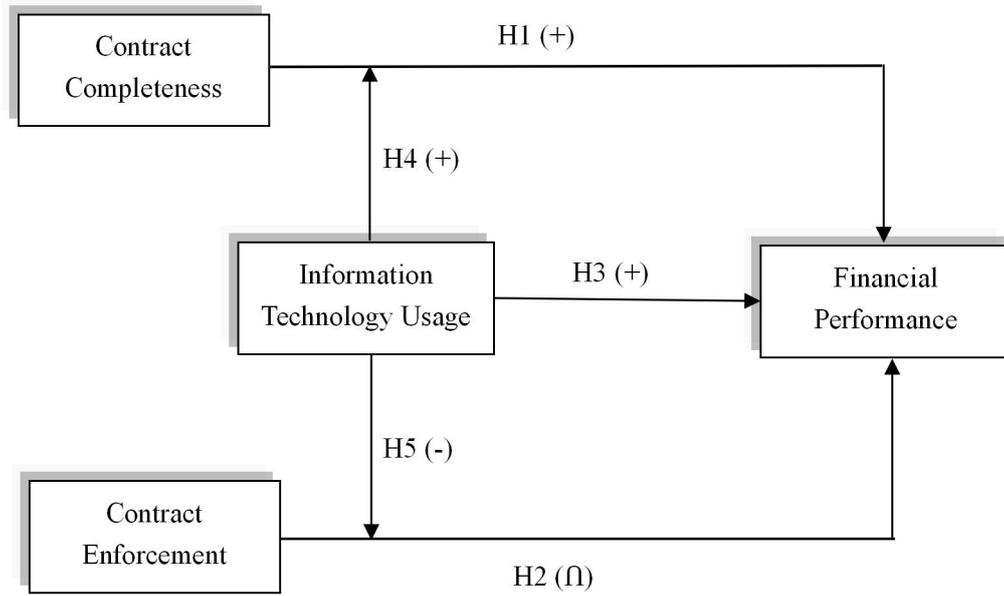


Figure 2

The interaction effect of contract completeness and information technology usage

