



Inter-firm dependence, inter-firm trust, and operational performance: The mediating effect of e-business integration



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ABSTRACT

The objective of this paper is to examine the relationships of relational governance, e-business integration, and operational performance in a supply chain context. We operationalize relational governance with inter-firm dependence and inter-firm trust to build a structural model. The empirical analysis of our survey data collected from manufacturing firms reveals that e-business integration significantly mediates the effects of inter-firm dependence and inter-firm trust on operational performance. The present work justifies the mediating mechanism of e-business integration and advances the understanding of the impact of relational governance on operational performance. The findings contribute to research and practice in e-business and supply chain management.

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1. Introduction

E-business plays an increasingly important role in facilitating the timely flow of information, materials, and goods throughout supply chains. In the context of supply chains, e-business integration refers to the assimilation and adaptation of Internet-based e-business operations, which enables firms to exchange information, share resources, and undertake continuous and collaborative activities. It is not uncommon for firms to develop inter-firm alliances to reduce costs, access complementary resources and capacities, and cope with market competition [14,57]. As a dominant aspect of inter-firm alliances, e-business integration not only reflects the state of interconnecting operational processes and business transactions but also materializes synergetic advantages of inter-firm alliances [11,52,53]. In this respect, efficient information exchange is of importance for exploring value-added opportunities and capitalizing on inter-firm resources and capabilities [38,56,68].

The existing works examining business-to-business supply chains and the relationship between e-business and firm performance suggest that e-business may help streamline information flow, improve customer service, and contribute to operational efficiency [34,39,63]. Recently, some studies have drawn attention to exploring firm performance from the perspective of relational

governance because relational governance can help firms to achieve collaborative advantages and address operational uncertainties and contingent risks [24,55,56,69,70]. Firms may implement relational governance in routine business operations by integrating e-business processes to enhance relationships and strengthen collaborations [1]. However, there is a research gap with regard to relational governance in association with e-business operations in the supply chain context. Therefore, more studies are needed to unveil the effect of relational governance on e-business integration, as firms are tightly coupling business processes with supply chain partners to leverage resources and capacities. It is particularly necessary to empirically examine antecedent relational factors and the causality of e-business integration to reveal the extent to which e-business integration mediates the relationship between relational governance and operational performance.

The above observations motivate us to conduct this empirical study. The objective of the present work is to articulate the relationships of relational governance, e-business integration, and operational performance in the supply chain context. Drawing on the theoretical underpinnings of relational governance, we design a structural model that includes such antecedent factors as inter-firm dependence and inter-firm trust. In particular, relational governance is operationalized as inter-firm dependence and inter-firm trust because both are the key facets of relational governance. The model is aimed at revealing the effects of inter-firm dependence and inter-firm trust on the formation of e-business integration and exploring the mediating effect of e-business

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integration on the relationship between relational governance and operational performance.

This study makes important contributions to research and practice. We systematically test our model and hypotheses using the survey data collected from manufacturing firms. The empirical results presented in the following section validate our theoretical model by revealing that e-business integration considerably mediates the effects of inter-firm dependence and inter-firm trust on operational performance. The analysis shows that the deployment of the relationship approach in e-business integration effectively enhances operational performance. Thus, the present work not only advances the theoretical understanding of the relationships between relational governance, e-business integration, and operational performance but also extends the notion of relational governance in the supply chain context by providing insights for managing e-business and supply chain operations.

This paper is structured as follows. The next section describes the theoretical foundation of our conceptual model and proposes five hypotheses. It then describes research methods and presents empirical results. Moreover, it discusses the research findings, theoretical and managerial implications, and limitations. Finally, it summarizes the empirical findings and highlights directions for future research.

2. Theoretical foundation and hypotheses

A critical issue on strategic alliances and supply chain management is how to effectively govern inter-firm relational resources to optimize operational performance [25]. The relational exchange norms [32,46,48], the relational view [16], the network resources [15,24], and the resource-based view [43] collectively emphasize relational governance as an important relational resource for enhancing alliance relationships and operational performance [1,54,62,65]. The existing literatures indicate that inter-firm dependence and inter-firm trust are fundamental facets of relational governance with regard to establishing and sustaining inter-firm relationships [24,25,29,41,45,51,69]. First, inter-firm dependence signifies the essential element of inter-firm relationships and specifies the necessity of mutual reliance and connectedness, through which firms carry out business-to-business operations and commercial exchanges [6,24,29,41,62,67]. Second, inter-firm trust reflects a firm's confidence in its exchange partners in terms of reliability and integrity [51,55,69]. Inter-firm dependence and inter-firm trust have been applied to examine inter-firm alliances and supply chains, suggesting that relational governance serves as

the theoretical underpinning for managing relationships between exchange parties and developing long-term collaborations and sustainable partnerships [23,45,47,48,69].

In this study, we extend relational governance as an overarching theoretical foundation for inter-firm alliances to articulate the extent to which relational governance affects e-business integration and the extent to which e-business integration mediates the effect of relational governance on operational performance in the context of supply chains. In particular, we consider inter-firm dependence and inter-firm trust to be precursors to e-business integration and attempt to advance the understanding of the role of e-business integration in the relationship between relational governance and operational performance. As depicted in Fig. 1, we create a conceptual research model that consists of four constructs, including inter-firm dependence, inter-firm trust, e-business integration, and operational performance, in which e-business integration is assumed to play a mediating role in conveying the impact of relational governance on operational performance. In the following subsections, five hypotheses are proposed to examine the effects of inter-firm dependence and inter-firm trust and the mediating effect of e-business integration.

2.1. Inter-firm dependence

In this study, inter-firm dependence refers to the extent to which a firm perceives its reliance on partners in supply chain operations. Previous works explore inter-dependence and suggest that it is commonly accepted that firms are unable to be autonomous and self-sufficient with respect to internal resources, capabilities, and strengths to meet the challenges of environmental change, market fluctuation, and competition [17,22,29,33,41]. Firms depend on business partners to expand their capabilities with inter-firm resources embedded in supply chains [33,43]. Further, we emphasize that inter-firm dependence is the mutual dependence between business partners with the practical goal of win-win solutions. Firms may appreciate the value of business partners' complimentary resources and capabilities and rely on the partners to strive for common interests [22,24,45,67].

In particular, inter-firm dependence is vital to the governance of the supply chain relationship [16]. First, it is an exchange tie developed from positive exchange experience that bonds partners together and forms supply chain relationships [49]. Hence, supply chain partners can access idiosyncratic or relation-specific assets including the exchange of proprietary information, knowledge,

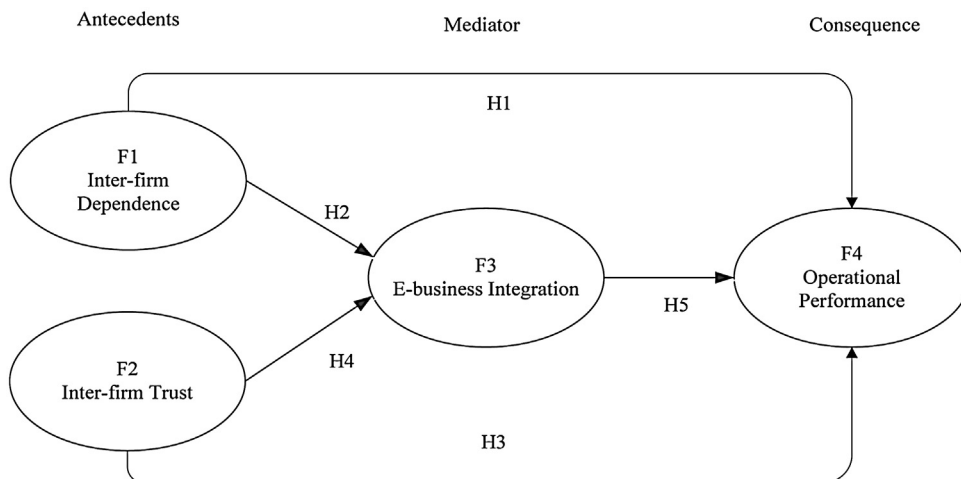


Fig. 1. Conceptual model.

and technical know-how [15,16]. In addition, inter-firm dependence may provide a safeguard for supply chain partners to suppress opportunistic behavior, reduce counterpart risks, and enhance commitment to the partnership [26,41,45]. It may also low negotiation and transaction costs, quick responses to customers, and high operational efficiency. Therefore, we propose [Hypothesis 1](#):

H1. Inter-firm dependence positively affects a firm's operational performance.

Internet-based e-business is increasingly important to supply chain operations, as firms tend to integrate business processes with supply chain partners when recognizing the value and importance of inter-firm dependence and cooperative advantage. Inter-firm dependence offers supply chain partners not only information sharing, complementary resources, and dynamic capability but also a reliable environment with reduced opportunistic behavior and transaction costs. Thus, it encourages firms to work together to develop inter-firm relationships, integrate business operations, and accelerate information flow with business partners [6,50]. The more important the inter-firm dependence is, the stronger the perception of strategic reliance will be [9]. Consequently, partners may be willing to make a relationship investment, which may result in establishing Internet-based e-business integration of routine processes and activities. When a firm perceives its dependence on partners and recognizes the importance and consequence of interdependent relationships, it has a need to develop e-business integration with supply chain partners [35]. Generalizing from these observations, we propose [Hypothesis 2](#).

H2. Inter-firm dependence positively affects a firm's e-business integration with supply chain partners.

2.2. Inter-firm trust

In the present work, inter-firm trust refers to a firm's belief that the partners are reliable and predictable in fulfilling obligations and performing promised actions [3,31,51]. Ring and Van de Ven [62] define trust as faith in the moral integrity of exchange partners, which is developed through business interactions and leads to interorganizational bonds in terms of common goals, sentiments, and relationships in the face of uncertainty. At the organizational level, a firm's boundary spanners such as supply chain managers and procurement managers are supply chain partners' representatives. As a reflection of the collective belief of boundary spanners, inter-firm trust helps firms predict the actions to be performed by supply chain partners in fulfilling obligations and promises and makes them work collaboratively in supply chain operations [3,31,44,69]. Therefore, we propose [Hypothesis 3](#).

H3. Inter-firm trust positively affects a firm's operational performance.

In the context of e-business integration, it is expected that inter-firm trust cultivates a conducive supply chain environment, not only fostering mutual confidence and enhancing cooperation and relationship stability but also leading to reductions in transaction costs, mitigation of opportunistic behavior, and reinforcement of relationships [36,44,62]. The existence of inter-firm trust suggests that firms have cooperative mindsets in business operations, which should result in supply chain partners' dedication to exchanging information and sharing resources [62,69]. With e-business integration, firms tend to share proprietary information and adaptively work with counterparts to

develop supply chain partnerships [16,25,54]. Thus, they should benefit from reducing risks and increasing opportunities through the exploration of joint actions [3,31]. Generalizing from these observations, we propose [Hypothesis 4](#).

H4. Inter-firm trust positively affects a firm's e-business integration with supply chain partners.

2.3. E-business integration and operational performance

It is imperative to explore the mediating role of e-business integration in inter-firm alliances because it may serve as an enabler that transforms the potential benefits of relational governance into operational performance. In line with the extended resource-based view, e-business integration may properly leverage relational governance, which can make it possible to obtain competitive advantage and create a synergetic effect whereby supply chain partners optimize resource utilization [43,58]. The firms may realize the potential of complimentary resources and capabilities through information sharing and inter-firm business process reengineering [38,56,68]. The aforementioned arguments suggest the possibility that e-business integration may mediate the linkage between relational governance and operational performance. In other words, e-business integration may leverage the relational resources embedded in inter-firm dependence and inter-firm trust to improve operational performance [43,69].

The existing studies suggest that e-business helps firms improve operational efficiency, information flow, and time-to-market of new products [10,27,28,34,37]. The supply chain partners may pursue e-business integration to effectively enhance operational performance [34,50]. In this study, operational performance refers to a firm's operational outcomes in terms of quality improvement, cost reduction, on-time delivery, lead-time reduction, and the ability to quickly respond to customer requests. These aspects can be measured in regular and ongoing business processes, which essentially reflect a firm's core competence derived from supply chain operations [14,31]. Therefore, we use operational performance as an endogenous construct in our structural model to operationalize the outcomes of capitalized inter-firm relational governance and propose [Hypothesis 5](#).

H5. E-business integration positively mediates the effects of inter-firm dependence and inter-firm trust on operational performance.

3. Method

3.1. Questionnaire design and pilot study

We used multiple observable variables to operationalize the constructs in our research model and designed a questionnaire for empirical study [30]. In particular, we identified relevant measures from the literature, categorized them in line with the manifested constructs in the supply chain context, and undertook a methodological process to develop measurement items with respect to each of the constructs in the research model. First, we derived five items to measure inter-firm dependence in line with prior studies [24,29,41,45,67]. Second, we adapted five items from [69] and made refinements to measure inter-firm trust. Third, we developed four items to measure e-business integration with reference to [12,27,28,34]. Moreover, we adapted five items to measure operational performance in line with the literature [10,11,14,31,34].

We designed a preliminary questionnaire in English and subsequently translated the English version into Chinese for pilot study. Considering the context of the present work, we used an

emic adaptation approach [18,21,64] and performed a back-translation from the Chinese version to a new English version. We then compared and refined the initial and back-translated English versions of the questionnaire to establish conceptual equivalence, and translated the English version of the questionnaire into a new Chinese version again to maintain methodological and conceptual equivalence. The questionnaire also includes the enquiry of demographical data. Thereafter, we conducted a pilot study by inviting fifteen managers with extensive experience from different companies to review the questionnaire. They thoroughly scrutinized the question items and offered comments to improve the relevant items and the wording of the observable variables. In light of the feedback from the managers, we revised and finalized the questionnaire for survey. Table 1 shows the descriptions of the items in relation to each of the constructs.

3.2. Data collection

It is essential to obtain data from knowledgeable respondents of organizational boundary spanners to test our research model [19,42]. As a leading manufacturing base in the world, China has a large number of manufacturing firms. These firms are involved in e-business and supply chain operations because they need to purchase a large amount of materials from different suppliers. Therefore, we carried out a survey in China to gather empirical data from managerial executives who were responsible for procurement management. In this process, we randomly selected 1500 manufacturing firms and distributed our questionnaire together with a cover letter to each of these firms. The respondents were requested to answer the relevant question items using a seven-point Likert-scale ranging from 1 'strongly disagree' to 7 'strongly agree'. They were also asked to provide demographic data such as work experience, years with a firm, position in a firm, firm size, and years with a supplier. The survey resulted in the collection of 332 responses from firms. The response rate is 22%. We discarded 27 copies after screening the returned questionnaires due to incomplete answers to some questions. Therefore, the useful sample size is 305, which includes manufacturing firms from different industrial sectors such as electronics and electrical appliance (21%), furniture and furnishing (15%), household

products (17%), stationery and office equipment (14%), computer and peripheral (12%), building material and machinery (9%), and others (12%). The responding firms are medium to large enterprises with 600–8000 employees. We adopt the procedure [4] to test the null hypothesis of mean differences by comparing the mean value differences of the survey data collected from the responding firms in three consecutive months and using the analysis of variance to test all observable variables to confirm that there are no significant mean differences.

3.3. Construct validity

We conduct a reliability test to assess the construct reliability and internal consistency of each construct using SmartPLS software. Table 1 presents the constructs and observable variables retained after validation with confirmatory factor analysis (CFA), which provides the results of the reliability test including the Cronbach alpha (α), composite reliability (CR), and average variance extracted (AVE). Because the alpha (α) values are greater than 0.70, the four constructs are well manifested by the relevant observable variables [13]. Table 2 shows descriptive statistics, correlation coefficients, discriminant statistics, and AVE values of the constructs.

Construct validity refers to the extent to which the observable variables actually measure a conceptualized construct that they are assumed to measure [13]. In this study, we evaluate the convergent validity and discriminant validity of the constructs. First, convergent validity refers to the extent to which a set of observable variables converges to a manifested construct with significance and high values of loadings. It tests whether the loading coefficient of an observable variable is significantly greater than twice the standard error, the coefficient is greater than 0.50, and the corresponding t -value is greater than 2.0 [2,5,20]. As shown in Table 1, the analytical results of the observable variables are significantly loaded onto the respective manifested constructs with high coefficient values and t -values, which justify the convergent validity of the four constructs. Second, discriminant validity refers to the extent to which a construct is truly distinctive from the other constructs. Thus, a high degree of discriminant validity provides evidence that a construct is unique and captures

Table 1
Measurement statistics.

Measurement items	Loading (t -value)	α	CR	AVE
<i>Inter-firm dependence</i>		0.811	0.868	0.569
The suppliers serve as strategic partners to our firm.	0.802 (12.03)			
The suppliers play a limited role in our firm's procurement operations (<i>R</i>).	0.679 (11.25)			
Our firm has developed strong connections with the suppliers.	0.823 (11.74)			
Our firm has collaborated with the suppliers in procurement.	0.724 (9.59)			
Our firm's procurement is dependent on the suppliers.	0.734 (10.45)			
<i>Inter-firm trust</i>		0.869	0.906	0.659
The suppliers reliably fulfill their promises.	0.882 (13.28)			
The suppliers care about the interests of our firm.	0.902 (13.68)			
The suppliers' behaviors are predictable.	0.778 (10.24)			
Our firm has confidence in the suppliers.	0.732 (12.23)			
Our firm and the suppliers have mutual trust.	0.749 (13.55)			
<i>E-business integration</i>		0.868	0.910	0.718
Our firm implements Internet-based procurement with the suppliers.	0.779 (12.58)			
Our e-business systems consistently exchange information with the suppliers.	0.827 (12.24)			
Our e-business systems enable collaborative operations with the suppliers.	0.903 (14.63)			
Our e-business systems integrate in-bound logistics with the suppliers.	0.875 (12.49)			
<i>Operational performance</i>		0.892	0.921	0.702
The quality of our products has been improved.	0.756 (12.25)			
The procurement cost of our firm has increased (<i>R</i>).	0.766 (12.21)			
The efficiency of our product delivery has increased.	0.891 (13.70)			
The lead time in our production operations has been reduced.	0.901 (13.89)			
Our firm is able to quickly respond to requests from customers.	0.862 (13.17)			

Notes: (*R*) means a reverse coded item. α refers to Cronbach's α value for construct internal consistency. CR refers to composite reliability. AVE refers to average variance extracted.

Table 2
Descriptive statistics and correlation matrix.

Construct/control variable	Mean	sd	Correlation matrix			
			F ₁	F ₂	F ₃	F ₄
Construct						
F ₁ . Inter-firm Dependence	5.01	1.00	0.569			
F ₂ . Inter-firm Trust	4.62	1.12	0.594*	0.659		
F ₃ . E-business Integration	4.48	1.38	0.431**	0.430**	0.718	
F ₄ . Operational Performance	4.54	1.36	0.451**	0.605**	0.600**	0.702
Control variable						
Work experience (year)	3.90	1.21	-0.067	-0.026	-0.054	0.124
Years with the firm (year)	2.91	1.49	-0.102	-0.123	-0.046	-0.075
Position in the firm	-	-	0.021	0.018	0.006	-0.004
Occupation in the firm	-	-	0.022	0.024	0.139	0.031
Firm size (thousand)	3.50	1.45	-0.024	-0.109	-0.021	-0.098
Years with the supplier (year)	3.62	1.73	0.027	-0.066	0.082	-0.041

Notes: AVE is reported on the diagonal of the constructs.

* $p < 0.05$.

** $p < 0.01$.

the propensity of the represented concept that other constructs do not. A construct’s discriminant validity is confirmed if its AVE value is greater than the squared correlation coefficients between the construct and each of the other constructs [5,20]. The results in Table 2 indicate that all AVE values of the constructs are greater than the squared correlation coefficients of the corresponding correlation pairs, which justify the discriminant validity of the constructs in the research model.

Following the guidance of [59], we assess the common method bias by adding a first-order construct in the structural model, which is manifested by all observable variables. The first-order factor serves as the common method factor that controls the common variance among the endogenous and exogenous constructs in the model. The results ‘with’ and ‘without’ the common method factor in the structural model indicate that there is no significant difference in terms of path parameters and goodness of fit indices. Hence, there is no significant common method bias in the data of observable variables. Moreover, we examine the fit criteria of the measurement model using CFA in AMOS software. The analytical outcomes include $\chi^2 = 354.054$, $df = 142$, $\chi^2/df = 2.493$, $NFI = 0.913$, $TLI = 0.935$, $CFI = 0.946$, $GFI = 0.888$, $IFI = 0.946$, and $RMSEA = 0.0702$. The observable variables are sufficiently loaded to their underlying constructs (loadings > 0.7). Therefore, the data analysis justifies the measurement model and the unidimensionality of the constructs in the structural model.

4. Results

We conduct hypothesis testing to unveil the statistical significances and implications of our research model [2,5]. First, we use structural equation modeling (SEM) and the maximum likelihood procedure of AMOS to estimate path coefficients of the structural model [8]. Second, we perform structural path analysis to test the structural model (M₁) together with three alternative models. As shown in Table 3, the indices of M₁ provide evidence for the goodness of fit of the model ($\chi^2 = 402.41$, $df = 142$, $\chi^2/df = 2.83$, $p < 0.001$, $NFI = 0.894$, $TLI = 0.908$, $CFI = 0.924$, $GFI = 0.883$, $IFI = 0.924$, $RMSEA = 0.078$), and the path coefficients significantly support the hypotheses H2–H5. However, these outcomes cannot confirm that M₁ is the mediation model with the best fit indices. Thus, we would like to determine whether alternative models are better than M₁ in terms of fit indices because an alternative model may exist with different explanatory power. Following the statistical inference and the testing procedure for the mediating effect [7], we apply a compelling model approach to strive for the best parsimonious model that helps identify the extent to which e-business integration mediates the relationship between inter-firm

dependence and operational performance as well as the relationship between inter-firm trust and operational performance.

In particular, we analyze three alternative models using SEM in association with AMOS, in which the χ^2 difference ($\Delta\chi^2$), p -value, and other goodness-of-fit indices are used to assess the improvement in model fitness [8,30]. The development of an alternative model is based on two principles. First, according to the existing literature on the likely cause-effect relationship and testing procedure of the mediating effect, we remove a path or paths in the structural model M₁ to create an alternative model. Second, given the indices from the analytical outputs, we judge the conceptual underpinnings of the improvement suggestions and then add or remove a path in the model to form an alternative model. Thus, three alternative models (M₂, M₃, and M₄) are tested as follows.

First, we develop an alternative model M₂ by removing two paths in M₁: One is the path between inter-firm dependence and operational performance (F₁ → F₄); the other is the path between inter-firm trust and operational performance (F₂ → F₄). M₂ tests the direct effect of the exogenous constructs (F₁ and F₂) on the endogenous construct of e-business integration (F₃) and the mediating effect of e-business integration on operational performance (F₄). The analytical results indicate a significant Chi-square difference ($\Delta\chi^2 = \chi^2_1 - \chi^2_2 = 64.38$). The effects of (F₁ → F₃),

Table 3
Analytical outcomes of structural equation modeling.

	M ₁	M ₂	M ₃	M ₄
H1 (F ₁ → F ₄)	0.115 (1.83)	-	0.118 (1.92)	-
H2 (F ₁ → F ₃)	0.314** (3.63)	0.313** (3.59)	0.298** (3.59)	0.325** (3.63)
H3 (F ₂ → F ₄)	0.453** (7.26)	-	-	0.451** (7.21)
H4 (F ₂ → F ₃)	0.246** (2.96)	0.245** (2.94)	0.250** (2.97)	0.246** (2.96)
H5 (F ₃ → F ₄)	0.480** (7.66)	0.482** (7.74)	0.473** (7.72)	0.489** (7.81)
χ^2	402.41	467.13	447.64	402.72
df	142	144	143	143
χ^2/df	2.83	3.24	3.13	2.82
$\Delta\chi^2$	-	64.38**	19.49**	64.41**
	$p < 0.01$	$p < 0.01$	$p < 0.01$	$p < 0.01$
NFI	0.894	0.870	0.875	0.919
TLI	0.908	0.889	0.893	0.915
CFI	0.924	0.905	0.911	0.924
GFI	0.883	0.871	0.873	0.893
IFI	0.924	0.906	0.912	0.925
RMSEA	0.078	0.086	0.084	0.076

Notes: $\Delta\chi^2 = (\chi^2_0 - \chi^2_i)$, $i = 1, 2, 3$.

The value in brackets is the t -value of a responding path coefficient; NFI = normed fit index; TLI = Tucker-Lewis index; CFI = comparative fit index; GFI = goodness-of-fit index; IFI = incremental fit index; RMSEA = root mean squared error of approximation.

** $p < 0.01$.

($F_2 \rightarrow F_3$), and ($F_3 \rightarrow F_4$) are also significant with coefficients of 0.313 ($t = 3.59, p < 0.01$), 0.245 ($t = 2.94, p < 0.01$), and 0.482 ($t = 7.74, p < 0.01$), respectively. Second, we develop another alternative model M_3 based on M_2 by adding a direct path from inter-firm dependence to operational performance ($F_1 \rightarrow F_4$), which tests the direct effect of the exogenous construct of inter-firm dependence (F_1) on the endogenous construct of operational performance (F_4). In comparison with the results of M_2 , there is a significant Chi-square difference ($\Delta\chi^2 = \chi_2^2 - \chi_3^2 = 19.49$). The effects of ($F_1 \rightarrow F_3$), ($F_2 \rightarrow F_3$), and ($F_3 \rightarrow F_4$) are also significant at the 0.01 level. However, the path of $F_1 \rightarrow F_4$ ($C_{F_1 \rightarrow F_4}$) is insignificant, which suggests that inter-firm dependence has little direct effect on operational performance. Third, we develop one more alternative model M_4 based on M_2 by adding a path from inter-firm trust to operational performance ($F_2 \rightarrow F_4$), which tests the direct effect of the exogenous construct of inter-firm trust (F_2) on the endogenous construct of operational performance (F_4). The analytical results of M_4 show a significant Chi-square difference ($\Delta\chi^2 = \chi_2^2 - \chi_3^2 = 64.41$). Particularly, in addition to the significant effects of ($F_1 \rightarrow F_3$), ($F_2 \rightarrow F_3$), and ($F_3 \rightarrow F_4$), it has been found that the effect of ($F_2 \rightarrow F_4$) is significant with coefficients of 0.451 ($t = 7.21, p < 0.01$). Thus, inter-firm trust has a positive and direct effect on operational performance.

In summary, the significant path coefficients resulting from our systematic tests empirically support **Hypothesis 2–5**, while **Hypothesis 1** receives limited support. As shown in **Table 3**, a comparison of M_1, M_2, M_3 , and M_4 suggests that the results of M_4 are relatively more comprehensive in terms of statistical significance and parsimonious model structure [2,30]. **Fig. 2** depicts the main results of M_4 , which especially indicate the mediating effect of e-business integration and the direct effect of inter-firm trust on operational performance.

5. Discussion

This study investigates the extent to which the effects of inter-firm dependence and inter-firm trust on operational performance are mediated by e-business integration in the supply chain context. We test our research model together with the hypotheses using the survey data collected from the manufacturing firms. The empirical results show that both inter-firm dependence and inter-firm trust have positive effects on e-business integration, while e-business integration significantly mediates these effects on operational performance.

The empirical results support the theoretical prediction that relational governance in terms of inter-firm dependence and inter-firm trust serves as a fundamental prerequisite for supply chain partners to integrate e-business processes and obtain embedded relational advantage. Actually, inter-firm dependence and inter-firm trust are exogenous constructs because both lay the relational foundations for fostering inter-firm e-business integration. The empirical results indicate that e-business integration mediates the effects of inter-firm dependence and inter-firm trust on operational performance. In particular, inter-firm dependence has a positive effect on e-business integration, which suggests that inter-firm dependence is fundamental because it materialize relational governance by developing and maintaining e-business integration. Though inter-firm dependence has a limited direct effect on operational performance as evidenced by the results of the hypothesis testing, it indirectly influences operational performance through e-business integration. Inter-firm dependence motivates firms to develop connections and form business partnerships in the circumstances of e-business and supply chain operations. At the same time, inter-firm trust has a significantly positive impact on both e-business integration and operational performance. The empirical results show that there is a significantly direct causal effect from inter-firm trust to operational performance. Actually, as an important facet of relational governance, inter-firm trust contributes to the improvement of operational efficiency and works as a sustainable safeguard for e-business integration and supply chain operations by mitigating opportunistic behavior on the part of partners, minimizing operational risks, and reducing inter-firm operational costs. Therefore, inter-firm trust helps enhance behavioral predictability and the confidence of supply chain partners.

The present findings have theoretical implications because they advance and enrich the understanding of e-business integration and inter-firm business cooperation in the supply chain context. First, e-business integration effectively capitalizes on inter-firm relational resources in supply chain operations. The construct of e-business integration is operationalized with the items that manifest the major activities associated with e-business. Second, our empirical analysis shows that e-business integration plays a significant role in enhancing operational performance through its mediating mechanism. It also confirms the construct of e-business integration with the properties of reliability and validity, which serves as a groundwork for further research on inter-firm e-business. Third, our findings broaden the

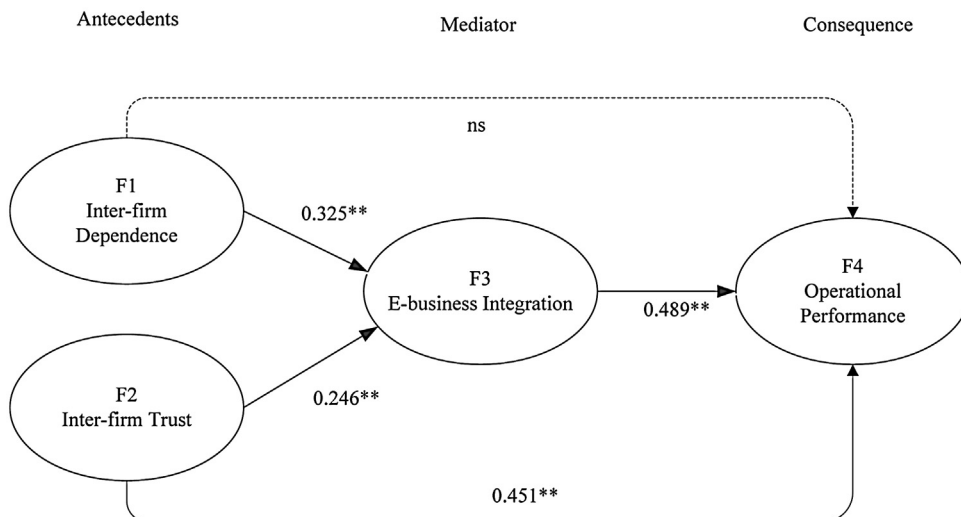


Fig. 2. Results of hypothesis testing.

extant knowledge by identifying and emphasizing the mediating effect of e-business integration of relational governance and operational performance. Such a mediating effect empirically justifies the assertion of trust-led cooperative advantage in association with e-business alliances [15,61]. Therefore, the present work not only extends the understanding of relational governance that acts as a precursor to the performance of e-business alliances but also shows that e-business integration serves as an important mechanism to transform relational governance into operational performance in the supply chain context.

The present findings also have managerial implications for e-business and supply chain management. We would suggest that firms implement the relationship approach to develop e-business integration and invest in relational governance when initiating and maintaining inter-firm relationships. Although legal contracts are essential to safeguard business interests and investments, the deployment of relational governance is important to effectively and efficiently carry out business-to-business operations [60,70]. The present findings provide empirical support for the implementation of relational governance in e-business and supply chain operations. In practice, supply chain partners may not fully depend on contractual provisions to govern business operations because even detailed contract terms cannot completely eliminate business risks in a changeable environment, while risks can be alleviated based on relational governance [23,32,67,70]. Thus, firms should cultivate a trustable supply chain environment by integrating e-business systems and supply chain operations. In addition, as e-business integration possesses a leveraging mechanism to capitalize on relational governance in supply chain operations, firms have greater flexibility to address operational risks in the dynamic marketplace. Therefore, we suggest that firms should not only integrate e-business systems with their business partners to share transaction data and streamline operational processes but also cooperatively work together to develop closer connections, establish mutual trust, and form sustainable supply chain partnerships. As a result, it helps supply chain partners strengthen cooperation, mitigate opportunistic behavior, and stabilize supply chain relationships [66]. In addition, it helps them develop competence in leveraging idiosyncratic and complementary capabilities and realize synergetic effects through efficient information sharing and collaborative operations. Moreover, as inter-firm transactions expand in scale and depth over time, e-business integration should be upgraded to achieve knowledge sharing and intangible resource management, as a consequence of which supply chain partners will further enhance relationship and achieve greater performance.

Nevertheless, the present study has its limitations. First, it uses cross-sectional data collected from supply chain boundary spanners to test our research model and hypotheses. In future studies, longitudinal data will be gathered to further justify the present findings. Second, the findings of this study are based on the survey data from the manufacturing firms in China. Thus, future studies may extend the present work to examine e-business integration in a multi-country research setting to generalize the findings. Finally, the present research model focuses on two core constructs of relational governance and the mediating effect of e-business integration on operational performance. Future studies may conceptualize and extend the present model with additional constructs to provide further understanding of e-business and supply chain operations in the changing environments.

6. Conclusion

The present work empirically examines the antecedent factors that foster and sustain the development of e-business integration from the relational governance perspective and articulates the

mediating effect of e-business integration on the relationship between relational governance and operational performance in the supply chain context. The findings provide important contributions to research and practice. The analytical outcomes reveal that e-business integration plays an important role in conveying relational governance to operational performance by mediating the effects of inter-firm dependence and inter-firm trust on operational performance. In particular, the findings advance the understanding of the leveraging mechanism of e-business integration between relational governance and operational performance, justify the direct and indirect effects of relational governance, and suggest that relational governance can serve as an effective approach to managing e-business operations in the supply chain context. It is believed that our work creates opportunities for further study of inter-firm e-business operations, especially with regard to intangible resources. Future research can be conducted in a longitudinal manner to explore the effect of relational governance on firm performance and examine the role of e-business in different inter-firm alliances. Future research can also be carried out to examine the extent to which firms can effectively transform intangible resources such as intellectual property, information, and knowledge into operational performance and achieve cooperative advantage through e-business integration.

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