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**A KNOWLEDGE TRANSFER PERSPECTIVE ON  
FRONT/BACK-OFFICE STRUCTURE AND NEW SERVICE  
DEVELOPMENT PERFORMANCE: AN EMPIRICAL STUDY  
OF RETAIL BANKING IN CHINA**

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**ABSTRACT**

Aim/Purpose	The purpose of this study is to investigate the mechanism of the front/back-office structure affecting new service development (NSD) performance and examine the role of knowledge transfer in the relationship between front/back-office structure and NSD.
Background	The separation of front and back-office has become the prevailing trend of the organizational transformation of modern service enterprises in the digital era. Yet, the influence of front and back-office separation dealing with new service development has not been widely researched.
Methodology	Building on the internal social capital perspective, a multivariate regression analysis was conducted to investigate the impact of front/back-office structure on the NSD performance through knowledge transfer as an intermediate variable. The data was collected through a survey questionnaire from 198 project-level officers in the commercial banking industry of China.

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Contribution	This study advances the understanding of front/back-office structure's influence mechanism on new service development activity. It reveals that knowledge transfer plays a critical role in bridging the impact of front and back-office separation to NSD performance under the trend of digitalization of service organizations.
Findings	This study verified the positive effects of front/back-office social capital on NSD performance. Moreover, knowledge transfer predicted the variation in NSD performance and fully mediated the effect of front/back-office social capital on NSD performance.
Recommendations for Practitioners	Service organizations should optimize knowledge transfer by promoting the social capital between front and back-office to overcome the negative effect organizational separation brings to NSD. Service and other organizations could explore developing an internal social network management platform, by which the internal social network could be visualized and dynamically managed.
Recommendations for Researchers	The introduction of information and communications technology not only divides the organization into front and back-office, but also reduces the face-to-face customer contact. The impacts of new forms of customer contact to new service development and knowledge transfer between customer and service organizations call for further research. Along with the digital servitization, some manufacturing organizations also separate front and back-offices. The current model can be applied and assessed further in manufacturing and other service sectors.
Impact on Society	The conclusion of this study guides us to pay attention to the construction of social capital inside organizations with front/back-office structure and implicates introducing and developing sociotechnical theory in front/back-office issue undergoing technological revolution.
Future Research	As this study is based on the retail banking industry, similar studies are called upon in other service sectors to identify differences and draw more general conclusions. In addition, as the front and back-offices are being replaced increasingly by information technology such as artificial intelligence (AI), it is necessary to advance the research on front/back-office research with a new theoretical perspective, such as sociotechnical theory.
Keywords	new service development, NSD, front and back-office, social capital, knowledge transfer

## INTRODUCTION

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In the 1990s, starting with the financial industry, service organizations separated the back office from the front office (Zomerdijk & Vries, 2007). The back office took charge of internal business processing, while the front office took charge of facing customers. This trend is expanding rapidly with the deepening of the digitalization of the service industry. The front/back-office structure has become almost a general organizational structure strategy of services enterprises (Rafaeli et al., 2017). It is first adopted by business-to-consumer (B2C) services, for instance, in bank and online travel agencies. Currently, it can also be seen in the highly knowledge-intensive business-to-business (B2B) service industries, for instance, auditing and consulting (Pemer, 2021), and even more widely in the manufacturing industry within the servitization context (J. H. Li et al., 2014). The existing research studies have discussed the influence of different configurations for separation of front and back office on operational efficiency and effectiveness (Gemmel et al., 2014, Raja et al., 2018). This organization structure change will also have a profound impact on new service development (NSD). There is

abundant literature exploring the impact on NSD from the front-office perspective (Karlsson et al., 2018; Santos-Vijande et al., 2016; Sjödin et al., 2019; Tate et al., 2018), however, there is a lack of research with a holistic perspective of the front/back-office configuration.

Separation of front and back office brings challenges to NSD in service organizations. It reduces interpersonal contact, solidifies business process, and expands knowledge distance. All of these hinder the knowledge transfer between customers and the organization, as well as between organization members, and ultimately affects NSD performance (J. H. Li et al., 2014). Therefore, in order to improve the innovation ability of service organizations, it is necessary to study the mechanism of front/back-office structure and how it affects NSD (Schneider & Bowen, 2019). Based on the framework of Social Capital theory, this paper analyzes the influence mechanism among the front/back-office structures, knowledge transfer, and NSD performance. It is proved that front/back-office social capital has a positive impact on NSD performance. The knowledge transfer mediates the impact of the front/back-office structure's social capital on NSD performance. According to the insight of the influence mechanism, we put forward practical management suggestions to promote NSD in modern service organizations at the end of the paper.

## LITERATURE REVIEW

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### *FRONT/BACK OFFICE*

It is a new trend of the service industry that the service process and organization are separated into front office and back office. The service front office refers to the departments in the service organizations directly facing customers, while the service back office refers to departments responsible for internal business processing, which are usually invisible to customers (Zomerdijk & Vries, 2007). The existing literatures widely discuss the operational efficiency of front/back office. One of the main themes of operational efficiency research is front/back-office configuration (Raja et al., 2018) and the structure-relationship setting of the front/back-office (J. H. Li & Huang, 2012). Another theme of the operational efficiency issue is business process reengineering, including modular service design (de Blok et al., 2014), and risk management (Zomerdijk & Vries, 2007). Recent research looks at the impact of the introduction of intelligent devices such as robots on operations (Marinova et al., 2017, Wirtz et al., 2018). Currently, research illuminates front/back office's impact on service innovation, although most of this research is from the front office perspective only (Tate et al., 2018), not from the front office and back office holistic perspective. This paper conducts a study on front/back office's impact on service innovation from a holistic configuration perspective.

### *KNOWLEDGE TRANSFER*

Knowledge transfer refers to the process of knowledge being created and transferred. The current research on knowledge transfer can be summarized into the following themes. (1) *Transfer process*. Although there are different opinions on the process stages of knowledge transfer, the three stages model is widely accepted, which identifies knowledge transfer as including preparation, transmission, and integration (Abekah-Nkrumah et al., 2018). (2) *Antecedents*. The antecedents affecting knowledge including knowledge characteristics, for instance, explicit or tacit knowledge (Szulanski, 1996), knowledge complexity (Simonin, 1999), characteristics of the participants of knowledge transfer, for example, participant willingness (Szulanski, 1996), intellectual level, coding capability (Hamel, 1991), transferring context, including relationship (Szulanski, 1996), culture distance (Darr & Kurtzberg, 2000), and physical distance (Kostova, 1999). (3) *Consequences*. The extant research illustrates knowledge transfer as having a positive influence on organizational operation performance and innovation performance (Bacon et al., 2019), both products innovation (Liu, 2019) and service innovation (J. H. Li et al., 2014).

## ***NEW SERVICE DEVELOPMENT (NSD)***

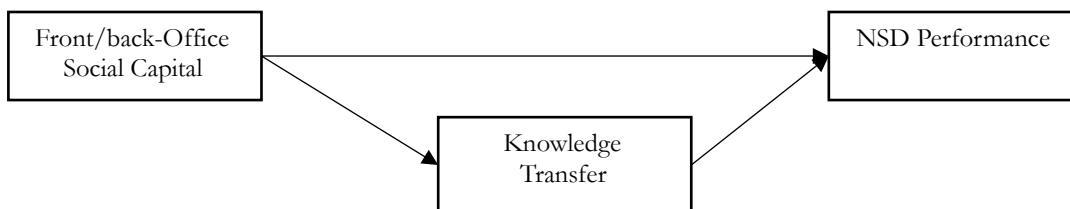
New Service Development (NSD) research commenced during the 1980s, and it stems from New Product Development (NPD). However, the discussions on NPD are not completely applicable to understanding NSD (Papastathopoulou & Hultink, 2012). In the past few decades, NSD research has gradually formed a methodological foundation that is different from NPD research. Existing NSD research focuses on two themes. The first theme is *Process and model* - it is a stream of literature refers to NSD tool optimizing (Jin et al., 2012), evaluation model developing (Jin et al., 2014), and optimal process identifying (Blommerde-Winters, 2022). The second theme is *Key success factors* (Zhu & Yan, 2013) - this stream of literature lists several organizational environment factors such as power and politics (Dreyer-Gibney et al., 2021), organizational structures in team, firm level (Bandinelli & Gamberi, 2012; Ghobadi & D'Ambra, 2013; Jaakkola & Hallin, 2018), and internal and external stakeholders relationship, including internal teams (Gounaris et al., 2020), customer participation (Gounaris et al., 2020), inter-organizational coordination (Tsou et al., 2019), and knowledge management (Pellizzoni et al., 2020). This paper conducts a study on front/back office's impact on service innovation from a holistic configuration perspective. In response to the latest service organization changes, this paper introduces front/back office into NSD research, which is a new organizational context.

## **THEORETICAL FRAMEWORK AND HYPOTHESIS**

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### ***THEORETICAL FRAMEWORK***

The impact of the inter-organizational relationship of service organizations on NSD performance has been verified already (Bonomi Santos & Spring, 2013). Recent research focuses on the internal organizational structural drivers of NSD, such as network centrality, and relationship strength (Hidalgo & Herrera, 2020). The front/back-office structure predictably has a profound impact on NSD performance. Knowledge transfer is one of the key antecedents of NSD performance (Bacon et al., 2020). This paper constructs a research conceptual framework of three concepts: front/back-office structure's social capital, knowledge transfer, and NSD performance. It is presented in Figure 1.



**Figure 1. Research Conceptual Framework**

We describe the structure of front/back office based on social capital theory. Tsai and Ghoshal (1998) proposed in their research that social capital includes three aspects: structure, relationship, and cognition. Structural social capital refers to the quantity and quality of connections within the organization. Relational social capital refers to the degree of mutual trust between organization members. Cognitive social capital refers to the degree to which the vision and knowledge background of organization members are aligned. Knowledge transfer is represented by knowledge sharing and knowledge integration (Nahapiet & Ghoshal, 1998). Knowledge sharing refers to the process in which individuals or organizations transmit their own knowledge (implicit or explicit knowledge) to others, so that knowledge can be reproduced in original or new forms (Ghahtarani et al., 2020). Knowledge integration refers to the process in which relevant knowledge is combined, applied, and absorbed (Bhandar, 2010). NSD performance is characterized by quality performance and efficiency performance (De Goeij et al., 2019).

## *THEORETICAL HYPOTHESIS*

### **Front/back-office social capital and NSD performance**

**Structural social capital and NSD performance.** Structural social capital is represented by two factors: connection density and connection strength. Connection density refers to the number of communication channels within the organizational internal social network, while connection strength refers to the frequency of interaction between organization members. Connection quality depends on connection density and connection strength (Wen et al., 2021). High connection density means abundant communication channels available within the organization, which contributes to convenient inner-organization communication (Mazzucchelli et al., 2021). Sometimes connection strength could compensate for low connection density, which means the connection quality can still be improved, even with rare connection, if the connection time is durable and frequency is high. The contact quality could be maintained at a high level if members could easily gain or offer knowledge that they need (Ahsan et al., 2020). Maintaining close and intense communication facilitates team members achieving consensus, enhances team members' sense of responsibility, and encourages team members to make greater efforts, thus improving innovation performance (Weber & Heidenreich, 2018). Therefore, the following hypotheses are proposed:

*H1: Connection density has a positive effect on NSD quality performance.*

*H2: Connection density has a positive effect on NSD efficiency performance.*

*H3: Connection strength has a positive effect on NSD quality performance.*

*H4: Connection strength has a positive effect on NSD efficiency performance.*

**Relational social capital and NSD performance.** Relational social capital refers to the emotional characteristics of connection (Wasko & Faraj, 2005), which can be represented as members' trust. Trust can improve the process quality of innovation tasks. In an organization with a high level of trust, members hold a more optimistic view on the group's ability and are more willing to accept other's opinions and suggestions. In addition, trust can reduce group conflicts. When the trust level is high, organizations may have a higher group authority and exert pressure on members who hold differing opinions, leading to a reduction in conflicts within the innovation activity (Hansen, 2012). On the other hand, group trust increases "beneficial conflict" (Jehn & Mannix, 2001). Task-related conflict may increase in groups with mutual trust because members feel safe enough to challenge other members' opinions without fear of being interpreted as personal attacks. The task process quality improvement, the harmful conflict reduction, and beneficial conflict induction can improve the performance of innovation activities. Therefore, the following hypotheses are proposed:

*H5: Member trust has a positive effect on NSD quality performance.*

*H6: Member trust has a positive effect on NSD efficiency performance.*

**Cognitive social capital and NSD performance.** Structural social capital is represented by two factors: shared vision and common language.

Shared vision refers to the shared culture and values within an organization (Nahapiet & Ghoshal, 1998), which is reflected as the clarity of the overall values of the organization and the acceptance of that by organization members. The shared vision can usually increase the dedication of members and reduce the resistance to collaboration, unnecessary friction and self-interested behavior, thus improving innovation performance (Mazzucchelli et al., 2021). Common language refers to the similarity of information and its processing mode within an organization. If the organization members share a common language, the coding process in communication will be faster, the probability of information omission and misreading will be lower, and the communication accuracy and efficiency will be higher. On the contrary, if there are cognitive conflicts caused by knowledge structures

differences (Hadjielias et al., 2021), coordination time will be increased and NSD performance will decline. Therefore, the following hypotheses are proposed:

*H7: Shared vision has a positive effect on NSD quality performance.*

*H8: Shared vision has a positive effect on NSD efficiency performance.*

*H9: Common language has a positive effect on NSD quality performance.*

*H10: Common language has a positive effect on NSD efficiency performance.*

### **The role of knowledge transfer**

Physical and psychological distance impedes knowledge transfer. Knowledge transfer within an organization would be blocked without connections. The degree of knowledge analysis and clustering is deeper and the frequency is higher with strong structural social capital (Robert et al., 2008). Overwhelming workloads crowd out opportunities for communication (Bolino et al., 2002). In a team with rich internal connections, members can easily find required and available experts (Riemer & Scifleet, 2012). Relational social capital can lubricate complex knowledge transfer (such as technological innovation in high-tech enterprises). Organizational trust can improve the openness of knowledge, enrich the quantity and types of knowledge, and provide an environment conducive to knowledge integration (Ekemen & Şeşen, 2020). Common cognition can increase members' ability of understanding each other. Team members can establish their own "technical terminology" with common understanding, which contributes to efficient communication. Members with common cognition have similar knowledge structures, which can help them rapidly form a precise understanding of the tasks; this also enables members to coordinate better (Expósito-Langa et al., 2015). In addition, members can quickly form a cognitive map of task-related information within the organization, so that information can be quickly processed into useful patterns for integration (Edmondson & Jean-François, 2018). It can be seen that knowledge transfer is an intermediate factor of the influence of organizational structure on innovation performance (Thneibat, 2021, Lopes et al., 2021). Therefore, the following hypotheses are proposed:

*H11: Knowledge transfer mediates the relationship between front/ back-office social capital and NSD quality performance.*

*H12: Knowledge transfer mediates the relationship between front/ back-office social capital and NSD efficiency performance.*

Based on the theoretical analysis above, an empirical conceptual model is proposed in Figure 2.

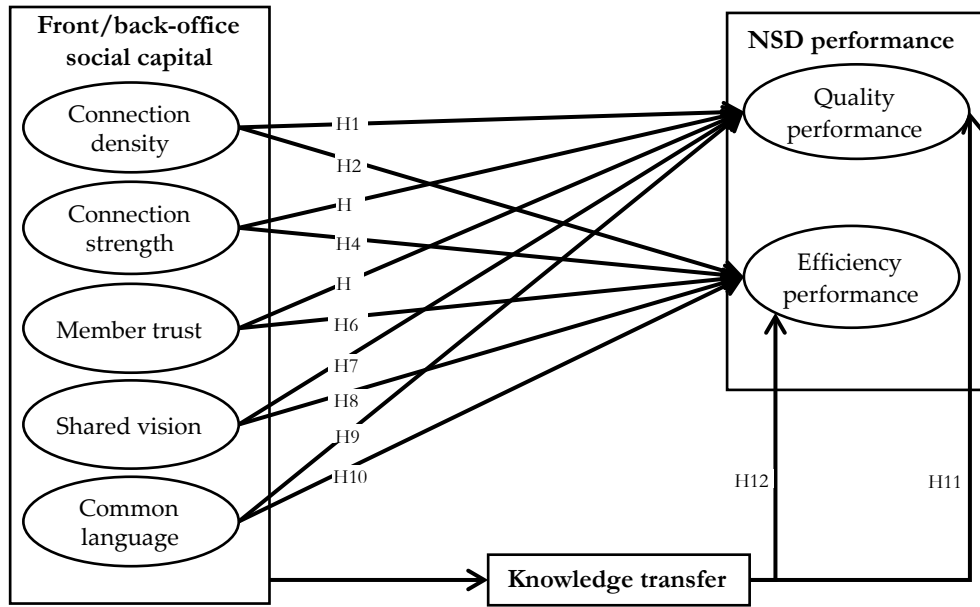


Figure 2. Empirical conceptual model

**METHODS**

*DATA COLLECTING*

The empirical research is based on questionnaire survey data. Respondents are front office and back-office employees who had been involved in at least one NSD project. We try to ensure each project has four personnel involved, including two front-office and two back-office members. A total of 240 questionnaires were sent out, 203 were collected (84.5%), with 198 valid questionnaires identified (82.5%). The numbers of questionnaires issued, collected, and identified as valid are shown in Table 1.

Table 1. Distribution of questionnaires

No.	Bank	Sent	Collected	Valid
1.	Bank of Hangzhou	15	12	12
2.	Bank of Ningbo	15	12	12
3.	Bank of Wenzhou	20	16	16
4.	Bank of Jiaxing	15	12	12
5.	Bank of Huzhou	15	12	12
6.	Bank of Shaoxing	15	12	12
7.	Bank of Jinhua	15	12	12
8.	Bank of Taizhou	10	12	10
9.	Zhejiang Tailong Commercial Bank	20	18	17
10.	Zhejiang Mintai Commercial Bank	20	18	18
11.	Zhejiang Chouzhou Commercial Bank	20	18	16
12.	Hangzhou United Rural Commercial Bank	15	13	13
13.	Zhejiang Hangzhou Yuhang Rural Cooperative Bank	5	4	4
14.	Zhejiang Leqing Rural Commercial Bank	5	4	4
15.	Zhejiang Shaoxing RuiFeng Rural Commercial Bank	15	12	12
16.	Zhejiang Jinhua Chengtai Rural Commercial Bank	10	8	8
17.	Zhejiang Yiwu Rural Commercial Bank	5	4	4
18.	Ningbo Yinzhou Rural Commercial Bank	5	4	4
<b>Summation</b>		<b>240</b>	<b>203</b>	<b>198</b>

### VARIABLE MEASUREMENT

The scale proposed by Nahapiet and Ghoshal (1998) was adopted for the measurement of front/back-office social capital. The structural social capital includes two factors: connection density and connection strength. The relational social capital is represented by member trust. The cognitive social capital includes two factors: shared vision and common language. Knowledge sharing was measured by J. Cheng and Li's scale (2001). Knowledge integration was measured by a scale with six questions, which was optimized based on Kogut and Zander's work (1992), according to the interviews. NSD performance is represented by two factors: quality performance and efficiency performance. The scale of quality performance was adopted from Schleimer and Shulman (2011). The efficiency performance measurement scale is integrated based on Rindfleisch and Moorman's (2001) and Carbonell's work (2012), which contains 5 items. All the factors are measured by using a Likert five-point scale. Questionnaire items are presented in the Appendix. To control factors as organizational size, industry attributes, and enterprise age that may affect test results, this study limits research objects to Zhejiang city commercial banks. These banks are of similar size and of similar age. In addition, the type of NSD project may also affects the relationship among social capital, knowledge transfer and innovation performance, so a dummy variable "project type" is set as a control variable to distinguish NSD projects. The NSD projects are divided into four types according to the degree of innovation. Each type is assigned a value from 1 to 4. The higher the innovation degree, the higher the dummy variable value.

### VALIDITY AND RELIABILITY

A reliability test was conducted to investigate the scale items reliability ( $R^2 > 0.50$ ), factors reliability (Cronbach's  $\alpha > 0.70$ ), and construction reliability ( $\rho_c > 0.60$ ). Convergent validity is tested with factor load ( $> 0.70$ ). All the scale items'  $R^2 > 0.50$ , indicating the scale items reliability is high. Cronbach's  $\alpha$  value of each factor is  $> 0.70$ , indicating all factors and scale items have good internal consistency.  $\rho_c$  of each factor is  $> 0.60$ , indicating the factors' measurement has good construction reliability. The factor load of all scale items  $> 0.70$ , indicates the convergent validity is high. Reliability and validity test results are shown in Table 2.

**Table 2. Validity and Reliability**

Variable	Factors	Items	R <sup>2</sup>	Cronbach's $\alpha$	$\rho_c$	Factor load	KMO	Variable-interpreted variance		
Structural social capital	Connection density	Q1.1	0.6163	0.8439	0.7444	0.833	0.837	62.30%		
		Q1.2	0.5734			0.817				
		Q1.3	0.5789			0.801				
		Q2.1	0.5350			0.785				
	Connection strength	Q2.2	0.5303			0.8626			0.7452	0.808
		Q2.3	0.5729							0.764
		Q2.4	0.5821							0.782
		Q3.1	0.6136							0.812
Relational social capital	Member trust	Q3.2	0.6202	0.8346	0.8029	0.838	0.815	72.30%		
		Q3.3	0.5821			0.804				
		Q3.4	0.6034			0.823				
		Q4.1	0.5016			0.785				
Cognitive social capital	Shared vision	Q4.2	0.5819	0.8451	0.795	0.823	0.86	65.10%		
		Q4.3	0.6254			0.814				
		Q4.4	0.5903			0.79				
		Q5.1	0.5171			0.854				
	Common language	Q5.2	0.5291			0.8033			0.7772	0.828
		Q5.3	0.5562							0.83
		Q5.4	0.5731							0.831
		Q6.1	0.5827							0.804
Knowledge Transfer	Knowledge sharing	Q6.2	0.5323	0.8341	0.7902	0.751	0.829	68.80%		
		Q6.3	0.6021			0.824				
		Q6.4	0.5811			0.77				
		Q6.5	0.5401			0.769				



Variable	Factors	Items	R <sup>2</sup>	Cronbach's $\alpha$	$\rho_c$	Factor load	KMO	Variable-inter- preted variance
NSD Performance	Knowledge integration	Q6.6	0.6193	0.835	0.8421	0.813	0.855	70.20%
		Q6.7	0.6317			0.818		
		Q6.8	0.6103			0.733		
		Q6.9	0.5993			0.761		
		Q6.10	0.5692			0.738		
	Quality performance	Q7.1	0.5721			0.856		
		Q7.2	0.5613			0.72		
		Q7.3	0.5702			0.848		
		Q7.4	0.6013			0.785		
		Q7.5	0.6107			0.851		
Efficiency performance	Q7.6	0.6005	0.801					
	Q8.1	0.5414	0.881					
	Q8.2	0.5685	0.758					
	Q8.3	0.5181	0.814					
	Q8.4	0.5344	0.736					
		Q8.5	0.535	0.775				
		Q9.1	0.537	0.834				
		Q9.2	0.568	0.798				
		Q9.3	0.604	0.794				
		Q9.4	0.599	0.799				
		Q9.5	0.566	0.756				

## RESULTS

### *CORRELATION AND MULTICOLLINEARITY*

#### Correlation analysis

The variable correlation analysis is shown in Table 3. Explaining variables (connection density, connection strength, member trust, shared vision, common language), intermediate variables (knowledge sharing, knowledge integration) and explained variables (NSD quality performance, NSD efficiency performance) show a significant correlation. There is also a significant correlation between intermediate variables (knowledge sharing, knowledge integration) and explained variables (NSD quality performance, NSD efficiency performance).

**Table 3. Variables Correlation (N=198)**

Variables	1	2	3	4	5	6	7	8
1 connection density								
2 connection strength	0.47**							
3 member trust	0.60**	0.43**						
4 shared vision	0.41**	0.23**	0.43**					
5 common language	0.40**	0.28**	0.47**	0.38**				
6 knowledge sharing	0.43**	0.41**	0.47**	0.53**	0.37**			
7 knowledge integration	0.17	0.28	0.43**	0.34**	0.57**	0.38***		
8 NSD quality performance	0.43***	0.44***	0.36**	0.38***	0.33***	0.58***	0.53***	
9 NSD efficiency performance	0.36***	0.41***	0.33**	0.29***	0.27***	0.40***	0.55***	0.64***

Notes: \*\*\*Denotes significance at  $p < 0.001$  (two-tailed test); \*\*denotes significance at  $p < 0.01$  (two-tailed test)

#### Multicollinearity analysis

There is usually some degree of correlation between the explaining variables. When the correlation degree of that is low, its deviation influence on the estimation results can be ignored; if the correlation degree of that is high, the deviation of regression coefficient estimation will be large, which will

cause the instability of the estimation. To avoid the problem of multicollinearity in regression analysis, the correlation coefficients among explaining variables should be analyzed before carrying out regression analysis. If the correlation coefficient between explaining variables is greater than 0.75, there may be a multicollinearity problem. As presented in Table 4, the correlation coefficients between explaining variables are all less than 0.75, so it can be preliminarily determined that the data in this study does not have a multicollinearity problem. However, correlation analysis is only applicable to determine the multicollinearity relationship between two variables. Hence, it is not applicable to determine the multicollinearity relationship between multiple variables. Tolerance (TOL) and Variance Inflation Factor (VIF) can be used to further test on the extent of each explaining how the variable is affected by multicollinearity. Usually, if  $TOL > 0.1$ ,  $VIF < 10$  it can be considered that there is no multicollinearity between explaining variables. As shown in Table 4, the TOL of all explaining variables is greater than 0.1, the maximum VIF is 6.474, which is far less than 10, so it can be judged that there is no multicollinearity problem. The correlation analysis and multicollinearity analysis above indicate that the survey data can be analyzed by hierarchical regression.

**Table 4. Tolerance (TOL) and Variance Inflation Factor (VIF) of Explaining Variables**

Explaining Variables	Tolerance (TOL)	Inflation Factor (VIF)
connection density	0.638	1.567
connection strength	0.220	4.555
member trust	0.453	2.209
shared vision	0.154	6.474
common language	0.401	2.493

### Hypothesis tests

This study uses regression analysis to detect the effect of front/back-office social capital and knowledge transfer with NSD performance (H1-H10). The statistic results are presented in Table 5. The project type has no significant effect on NSD quality performance (Model 1) and NSD efficiency performance (Model 9). Further, the results show that connection density (H1, Model 2), connection strength (H3, Model 3), member trust (H5, Model 4), shared vision (H7, Model 5), common language (H9, Model 6) have a positive effect on NSD quality performance. Thus, hypotheses H1, H3, H5, H7, H9, are supported. In addition, connection density (H2, Model 8), connection strength (H4, Model 9), member trust (H6, Model 10), shared vision (H8, Model 11), common language (H10, Model 12) have a positive effect on NSD efficiency performance. Thus, hypotheses H2, H4, H6, H8, H10, are supported as well.

Table 5. Results of regression analysis with front/back-office social capital, knowledge transfer on NSD performance

Variable	NSD quality performance					NSD efficiency performance						
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
Constant	-0.435	-0.519	-0.494	-0.509	-0.783	-0.694	-0.339	-0.135	-0.235	-0.230	-0.737	-0.842
Control variable	0.163	0.163	0.192	0.217	0.258	0.216	-0.152	-0.252	-0.291	0.261	0.178	0.301
Explaining variable												
Connection density		0.252***						0.312***				
Connection strength			0.361***						0.291***			
Member trust				0.221**						0.202**		
Shared vision					0.328***						0.181***	
Common language						0.201***						0.181***
<b>Model statistic</b>												
R <sup>2</sup>	0.034	0.334	0.381	0.438	0.372	0.428	0.062	0.419	0.471	0.436	0.319	0.391
Adjusted R <sup>2</sup>	0.03	0.318	0.362	0.402	0.365	0.419	0.059	0.401	0.418	0.422	0.315	0.383
F	1.534	22.341***	20.151***	17.627**	13.561***	19.257***	1.31	25.120***	24.681***	19.021**	16.197***	28.45***

Notes: \*\*\*Denotes significance at  $p < 0.001$  (two-tailed test); \*\*denotes significance at  $p < 0.01$  (two-tailed test)

The sequential regression coefficient test method (Zhonglin et al., 2004) was used to test the mediating effect of knowledge transfer. The first step is to check whether the regression coefficient between the explaining variables and the explained variables are significant. If it is not, the mediating effect test is abandoned. The second step is to check whether the coefficients of the explaining variables to the mediating variable and the mediating variable to the explained variable are significant. If both are significant, the third step is carried out. If either one of two coefficients is not significant, the Sobel test is involved. In the third step, the explaining variables and the mediating variable are put into a regression model with the explained variable at the same time. If the regression coefficient is significant, the mediating factor plays a partial mediating role, otherwise, it plays a fully mediating role.

The formula of Sobel test is:

$$Z = \frac{\alpha\beta}{\sqrt{\alpha^2SE\alpha^2 - \beta^2SE\beta^2}}$$

In the formula,  $\alpha$  is the estimated value of the explaining variable to the intermediate variable, and  $\beta$  is the estimated value of the intermediate variable to the explained variable.  $SE\alpha$  and  $SE\beta$  are the standard errors of  $\alpha$  and  $\beta$  respectively. The critical value of  $Z$  in the Sobel test is 0.97 ( $P < 0.05$ ), that is, mediating effect can only be determined when the  $Z$ -value  $> 0.97$ , at a significance probability  $P < 0.05$  level. However, the first and second steps, together with the Sobel test, can only support to determine a partial mediating effect.

Table 6 shows the statistic results with and without intermediate variable knowledge transfer. The statistic results show that the front/back-office social capital is positively correlated with NSD quality performance (Model 13) and efficiency performance (Model 15), the knowledge transfer is significantly positively correlated with NSD quality performance (Model 14) and efficiency performance (Model 16), the front/back-office social capital is significantly positively correlated with knowledge transfer (Model 17). The statistic results also show that the explaining variable (front/back-office social capital), intermediate variable (knowledge transfer) are significantly correlated with explained variables NSD quality performance (Model 18) and NSD efficiency performance (Model 19). It can be seen from the comparison between Model 18 and Model 13 that the correlation coefficient between front/back-office social capital and quality performance is still significant after introducing knowledge transfer, although the data drops from  $\beta = 0.512$  to  $\beta' = 0.112$ . It can be found from comparison between Model 19 and Model 15 that the correlation coefficient between front/back-office social capital and efficiency performance is still significant after introducing knowledge transfer, although decreases from  $\beta = 0.622$  to  $\beta' = 0.125$ . Therefore, according to Zhonglin et al. (2004), it can be concluded that knowledge transfer has a significant mediating effect on the quality NSD performance and efficiency performance. Hence, H15 is supported in this study.

The statistic results including direct effect of front/back-office social capital on NSD performance and mediating effect of knowledge transfer are all displayed in Figure 3.

**Table 6. Regression analysis with and without intermediate variable**

Model	Model 13	Model 14	Model 15	Model 16	Model 17	Model 18	Model 19
Variable	NSD quality performance	NSD quality performance	NSD efficiency performance	NSD efficiency performance	Knowledge transfer	NSD quality performance	NSD efficiency performance
<b>Constant</b>	-0.519	-0.907	-0.135	-0.193	-0.642	-0.341	0.415
<b>Control variable</b>							
Project type	0.163	0.109	-0.252	-0.225	0.115**	0.141	-0.164
<b>Explaining variable</b>							
Front/back-office social capital	0.512***		0.622***		0.317**	0.112**	0.125**
<b>Intermediate variable</b>							
Knowledge transfer		0.472***		0.633***		0.127**	0.127**

Model	Model 13	Model 14	Model 15	Model 16	Model 17	Model 18	Model 19
<b>Model statistic</b>							
R <sup>2</sup>	0.334	0.419	0.298	0.350	0.502	0.581	0.627
Adjusted R <sup>2</sup>	0.318	0.401	0.295	0.338	0.482	0.568	0.602
F	22.341***	25.120***	12.002***	7.326***	5.345**	24.401***	26.192***

Note: \*\*\* denotes significance at  $p < 0.001$  two-tailed test ; \*\* denotes significance at  $p < 0.01$  two-tailed test .

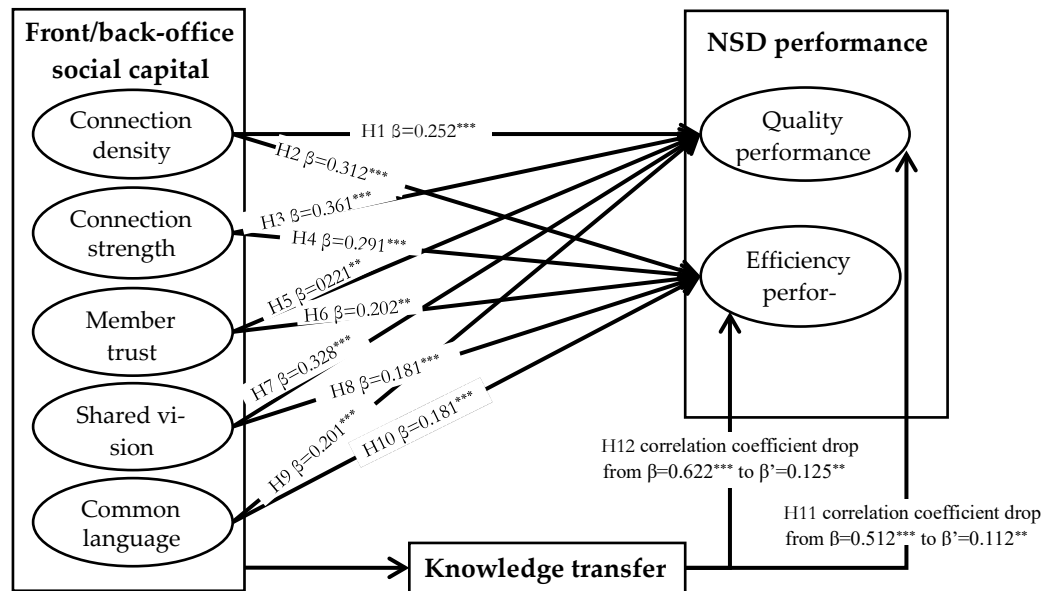


Figure 3. Hypothesis tests results

Notes: \*\*\* denotes significance at  $p < 0.001$ ; \*\* denotes significance at  $p < 0.01$

## DISCUSSION

To investigate the relationship of front/back-office social capital and knowledge transfer with NSD performance, we conducted regression analysis to test H1-H10. The regression analysis results show that the structural social capital of front/back-office has direct positive impact on both NSD quality performance and efficiency performance of the banking service. Hence, H1, H2, H3, H4 are supported by demonstrating that connection density and connection strength are important antecedents of NSD quality and efficiency performance. This significant positive effect of connection between front and back-office on NSD is consistent with the finding of Ahsan et al. (2020), who found the positive effect of team member’s connection on team innovation performance under a digital working context. That finding implies that bank organizations should put more emphasis on embracing various management arrangements and tools to enhance the connection between the front and back office. The more connection channels between the front and back office, the more opportunities for communication will be created for NSD. Deeper and longer communication will improve the quality of information communication between front and back-office members, thus promoting NSD efficiency and quality. The regression analysis result shows that the relational social capital of front/back-office has direct positive impact on both NSD quality performance and efficiency performance. Hence, H5 and H6 are supported by answering member trust as antecedents of NSD quality and efficiency. It is consistent with the previous findings of Young (2020) that trust inside organizations can promote organizational innovation. What’s more, Sankowska (2016) proposed in one study that the most important direct impact of organizational trust is on innovation, and the impact on

other aspects such as operational efficiency is only the result of the mediating effect of innovation performance. This finding suggests that, although we could set up various digital communications, including social media, email, IM (instant messaging) and so on, we still should strengthen non-technical-based social communication to increase the trust between front/back-office personnel to prevent possible decline in innovation ability (J. Li et al., 2021). The trust between front and back-office members encourages them to air their opinions, accept each other's views, and express different opinions more confidently. This contributes to more sufficient communication and improves the NSD performance. The regression analysis result shows that the cognitive social capital of front/back office has direct positive impact on both NSD quality performance and efficiency performance. Hence, H7, H8, H9, H10 are supported by demonstrating shared vision and common language as important antecedents of NSD quality and efficiency performance. Shared vision enables an organization's members to work together, increasing the degree of cooperation between front and back-office members, and expressing a common language between front and back-office members helps them to understand each other easily, both of which benefit NSD. Although this is not a new discovery, many studies have confirmed the positive impact of organizational cognition on service innovation. We would like to emphasize that it is even more important to realize knowledge cognition when working with partners with knowledge distance in IT-enabled organization context (Cui et al., 2020).

To investigate the role of knowledge transfer in relationship between front/back-office social capital and NSD performance, we conducted regression analysis to test H11 and H12. The regression analysis result shows knowledge transfer mediating the link of front/back-office social capital to NSD performance in the bank industry. The latest research from manufacturing (Thneibat, 2021) and the construction industry (Wang et al., 2021) also confirms the mediating role of knowledge transfer between innovation and its antecedents. Compared with these two studies, knowledge transfer seems to play a more important mediating role in banking enterprises. As although similar to our study, Wang's (2021) study also confirmed that knowledge transfer plays a partial mediating role. However, in our study, the test shows that the mediating effect of knowledge transfer tends to be a complete mediating effect (as the significance level drops from  $p < 0.001$  to  $p < 0.01$ ). It may mean that knowledge transfer is more critical in service organizations with separated front and back offices, than in manufacturing or construction industries. If this is true, it means we need to pay more attention to knowledge management in the service industry.

## CONCLUSION

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This study is conducted with two objectives: first, to examine the direct effect of front/back-office social capital on NSD performance, and second, to examine the mediating effect of knowledge transfer on the link between front/back-office social capital and NSD performance in the context of retail banking in China. The proposed theoretical model was tested to achieve research objectives. The results provide empirical evidence supporting the conceptual model, as all hypotheses passed the test. Therefore, our research proved that front/back-office social capital has a positive impact on NSD performance. More specifically, all the three dimensions front/back-office social capital-cognitive social capital, relational social capital and cognitive social capital have positive effects on both NSD quality performance and NSD efficiency performance. The knowledge transfer mediates the impact relationship of the front/back-office social capital with NSD quality performance and NSD efficiency performance.

## MANAGERIAL IMPLICATIONS

### Optimize the knowledge transfer between front and back-office

Firstly, this study reveals that diversified communication channels should be established in organizations. Communication occasions and channels like meetings and job rotation are common

management arrangements organizations use. Based on the conclusions we suggest that organizations with front and back-offices should also make full use of information tools like Office Automation (OA) and social media to provide more alternative channels for the communication of front and back-office personnel, ensuring they can find communication channels whenever they need. Organizations should also connect front and back-office members by having multifunctional teams working together to ensure front and back-office members can conduct deep communication during NSD. It is important to note that not all projects need to be close links, sometimes the weak links help to improve the efficiency of new service development.

Secondly, organizations should enhance the social relationships among front and back members to connect front and back-office members virtually while they are separated physically. Especially, it is necessary for the organization to enhance mutual trust among the front and back-office members through various team building activities to promote psychological contracts (Kim et al., 2018).

Thirdly, it is suggested to establish an organization's shared vision. Organizations can adopt diversified measures, such as corporate schools or induction training, to foster a spirit of collectivism among front and back-office members and to create a shared vision. For example, the "Tailong College" of Tailong Bank is an effective example publicizing its corporate vision, corporate culture, and corporate strategy. All new recruits are enrolled in a three-month introduction training course at Tailong College before they step into the job and are also provided with regular training during their employment at Tailong Bank. This arrangement plays an important role in the promotion and shaping of the corporate culture, spreading the innovative corporate culture to every employee and greatly increasing the cohesion within the organization. In addition, the organization should help the front and back-office members to become familiar with each other's knowledge field. To this end, service organizations should consider job rotation or regular training to improve the front and back-offices members' mutual understanding of each other's business knowledge. In short, the organization should minimize the knowledge differences between front and back-office members.

Finally, service organizations should enhance internal social capital by improving recruitment and personnel assessment. Psychometric techniques can be used to assess the collaborative spirit of recruits and the compatibility between their personalities and organizational culture. The front and back-office members' personnel assessment should introduce mutual evaluation or increase the weight of group performance, so as to guide members to "work as a team" instead of "working in isolation."

### **Establish internal network dynamic management**

The findings show that social capital between front and back-offices plays an important role on NSD. It enlightens the necessity of introducing management methods from the perspective of social networking in service organizations. To introduce social-network-based management, we have to be aware of the interpersonal network dynamic. Therefore, service organizations should set up a management system to optimize organization internal social network, for instance, to establish a dynamic internal social network management mechanism. Service organizations can develop a dynamic management platform (Friedman et al., 2014). With the platform, the organization could visualize, monitor and manage the internal social network (Burns & Friedman, 2012). For example, organizations can use it to identify harmful informal cliques and prevent them from forming. Organizations can also use such types of management platform to identify structural holes of the social network within the organization and identify members' contributions accurately and reward them accordingly in a NSD project. Furthermore, with the help of an internal social network management platform, it is easy to find the organization members' personal network. Organizations can build NSD project teams more accurately according to the work background and personal social network shown in the platform.

### ***LIMITATIONS AND FURTHER RESEARCH***

This study conducted a survey of the retail banking industry in China to investigate the front/back-office structure's influence mechanism and influence on NSD. The findings may not be applicable to other service sectors, such as online tourism and the professional services industry. In the future, similar empirical studies in other service sectors are expected to identify differences and draw more general conclusions. Even for manufactures carrying servitization strategy, it is needed to explore the innovation performance impact of the front/back-office structure. Jung-Kuei (2016) has done this exploration by compare the effect of frontline employee co-creation on service innovation between manufacturing and service industries.

Furthermore, it can be predicted that the front and back-office members and processes will be replaced by information technology like artificial intelligence (AI), which brings a new challenge for future service innovation (Peters et al., 2016). Therefore, we strongly recommend introducing and developing sociotechnical theory (Rafaeli et al., 2017) into future service front/back-office research.

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## APPENDIX

### *QUESTIONNAIRE ITEMS*

<b>Part 1 Front/back-office social capital</b>	
1	We have a good personal relationship
2	We often discuss problems together
3	We communicate and cooperate well at work
4	We have informal social events like dinners
5	We have frequent discussions
6	We communicate by telephone, electronic software, instant messenger and so on
7	We talk informally in the company cafeteria, break room, hallway, etc
8	Most of the time we can match our words with our actions
9	We consider each other's commitment to be credible
10	We help each other when others are in trouble in their work
11	We trust each other's ability to work
12	We have quite the same view on the prospect of the project
13	We have a common understanding of the important issues of the project (such as key technologies)
14	We agree on the overall objectives of the project.
15	We were able to reach a consensus on the most critical decisions of the project
16	We can understand their technical terms very well
17	We quickly understood the project problems they described
18	The symbols, terms of the professional fields involved in our team's projects are very clear
19	We are familiar with the tools (software, business manual) involved in the project
<b>Part 2 Knowledge transfer</b>	
20	I am willing to share my knowledge and experience with others
21	When I participate in a colleague's discussion, I usually offer my best input
22	When my colleagues ask me questions, I will try my best to answer them
23	When writing a document or report, I usually try to record what I know
24	I am happy to show my colleagues what is not easy to explain
25	I would like to offer my less experienced colleagues a chance to try
26	When colleagues need, I will try my best to provide them with the data and documents they need
27	When I can't help my colleague solve his difficulties, I will guide him to others
28	I will encourage my colleague when he meets difficulties in his work
29	When I teach my colleagues, I try to express myself in a way that they can understand
30	New knowledge generated in the project can be closely integrated/complementary to existing knowledge
31	Projects can smoothly integrate knowledge from different areas related to new product development
32	The new knowledge generated in the project can be adapted as the environment changes
33	We can integrate our procedures
34	We can integrate all kinds of experts to work together
35	Our ability to observe and imitate is very strong

Part 3 NSD performance	
36	The operation process of the new service is better than expected
37	New service development costs are lower than expected
38	The new service offering features better than expected
39	Customer satisfaction with new service products
40	New service provide customer value
41	New service have helped retain customers
42	Development time is shorter than we expected
43	Development is faster than we expected
44	Development was faster than average
45	The development cycle is shorter than that of other products in the enterprise

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