Mechanism and Empirical Research on the Impact of Structural Embeddedness on Enterprise Competitive Intelligence Performance: Postprint

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Abstract

[Purpose/Significance] Competitive intelligence activities of enterprises are inseparable from social networks. By investigating the formation of structural embeddedness and its influence on intelligence performance, this study constructs a mechanism model of structural embeddedness affecting intelligence performance, providing support for enriching competitive intelligence theory and improving enterprises' intelligence strategic capabilities.

[Method/Process] With enterprises that understand and engage in competitive intelligence work as research subjects, and employing methods such as questionnaires and structural equation model fitting, this study analyzes the mechanism by which the dimensions of structural embeddedness—network size, network position, and network density—influence intelligence performance.

[Results/Conclusion] The results indicate that competitive intelligence work necessitates structural embeddedness. Furthermore, the expansion of network size is especially advantageous for identifying, screening, and filtering needed intelligence.

Full Text

Structural Embeddedness and Its Impact on Enterprise Competitive Intelligence Performance: Mechanism and Empirical Research

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Abstract: [Purpose/Significance] Enterprise competitive intelligence activities are inseparable from social networks. By exploring the formation of structural embeddedness and its impact on intelligence performance, this study constructs a mechanism model of how structural embeddedness affects intelligence performance, providing support for enriching competitive intelligence theory and enhancing enterprise intelligence strategic capabilities. [Method/Process] Taking enterprises that understand and conduct competitive intelligence work as research subjects, this study employs questionnaire surveys and structural equation model fitting to analyze the mechanisms through which structural embeddedness dimensions—network scale, network status, and network density—influence intelligence performance. [Result/Conclusion] The findings reveal that competitive intelligence work requires structural embeddedness, and that network scale expansion is particularly beneficial for identifying, screening, and filtering required intelligence.

Keywords: structural embeddedness; enterprise competitive intelligence work; intelligence performance
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External resources must flow or spill over to enterprises through effective network embedding to be utilized [?]. To acquire intelligence resources, enterprises embed themselves in various business activities, establishing intelligence relationships with economic entities—suppliers, distributors, customers, etc.—to form embedded interpersonal intelligence networks for competitive intelligence work. Embeddedness is a pattern where an actor' s social relationships and networks influence its behavior. Structural embeddedness manifests as overall network structural characteristics, such as network status and network density, that affect intelligence behavior. Structural embeddedness not only ensures enterprises obtain high-quality intelligence [?] but also enables intelligence resources to flow orderly according to the builder' s intentions [?]. Moreover, different degrees of structural embeddedness lead to significant differences in transmitted intelligence [?]. Scholars such as A. Berger [?], P.N. Davies [?], and J.E. Prescott [?] have explored the structural embeddedness of interpersonal intelligence networks. Bao Changhuo [?] and Qin Tiehui [?] have also repeatedly emphasized the importance of embeddedness for intelligence work. Although scholars have studied structural embeddedness phenomena and made progress—for instance, B.J. Jaworski found that network scale and status affect intelligence collection [?]; V. Gilsing confirmed that network position and density jointly influence intelligence flow [?]; M.A. Schilling argued that network scale guarantees heterogeneous intelligence acquisition [?]; B. Uzzi determined that network centrality provides more opportunities for information access [?]; and G. Vasudeva proved that structural embeddedness positively affects knowledge acquisition [?]—their interpretations of how structural embeddedness influences competitive intelligence activities remain insufficiently clear, and empirical research is relatively lacking. Based on this, this study selected multiple enterprises that understand and value competitive intelligence work to analyze the mechanisms through which structural embeddedness characteristics affect intelligence performance, revealing the actual mechanisms through which structural embeddedness influences competitive intelligence work, with the aim of providing reference for Chinese enterprises' interpersonal intelligence network structural embeddedness construction.

2. Structural Embeddedness Phenomenon in Enterprise Competitive Intelligence Work

2.1 Meaning, Importance, and Dimension Division of Structural Embeddedness

Regarding structural embeddedness, G. Simmel described it as "formed by interwoven social relationships and influencing group life" [?]. M. Granovetter defined structural embeddedness as "groups connecting through third parties to form system-characterized association structures," manifested as network structural features. Scholars believe that nodes occupying structural hole positions have control over unconnected parties, that the content and methods of structural embeddedness affect network member behavior, and that network norms are easily formed. In summary, structural embeddedness attributes determine differences in enterprises' ability to acquire external resource endowments.

To deeply analyze structural embeddedness characteristics, scholars have divided it into dimensions. For example, M. Granovetter measured structural embeddedness through network position, network scale, and network density [?]; B. Uzzi used network density and network position as indicators [?]; S. Zukin and P. DiMaggio considered network density and network range as important dimensions [?]; W. Shan advocated measuring structural embeddedness through network position and relationship numbers [?]; and D.R. Gnyawali identified network centrality, structural autonomy, structural balance, and network density as main dimensions [?].

Reviewing these perspectives reveals that network scale, network range, network position, network centrality, and network density are high-frequency terms. Referencing social network measurement methods, this study divides structural embeddedness into three dimensions: network scale, network status, and network density. The logical relationships among these dimensions are shown in Figure 1 [Figure 1: see original paper] (subdivision basis see 3.1, 3.2, and 3.3).

2.2 Existence of Structural Embeddedness in Enterprise Competitive Intelligence Work

To acquire intelligence, enterprises proactively establish connections with nodes in various business activities: customers, suppliers, partners, etc. These relationships collectively form the enterprise' s external interpersonal intelligence network. According to M.H. Julie' s criteria [?], this network exhibits structural embeddedness characteristics because: (1) network members are the embedded physical elements, network structure is the container for intelligence behavior, and intelligence resources are embedded within the network structure; (2) the embedded structure and form, as well as the ways intelligence resources are embedded, determine the quality and efficiency of enterprise intelligence acquisition. E. Ortoll, Bao Changhuo, Wu Xiaowei, Ding Qiujin, and Peng Jingli all believe that structural embeddedness phenomena exist in competitive intelligence work.

3. Impact of Structural Embeddedness Dimensions on Competitive Intelligence Work

To understand the mechanisms through which structural embeddedness affects intelligence performance, this study first reviewed relevant intelligence performance research, selected intelligence performance measurement indicators, and then interpreted how each of the three structural embeddedness dimensions affects these indicators.

Regarding intelligence performance indicator selection, this study referenced both qualitative measurement perspectives from J.P. Herring [?], L. Fuld [?], Aurora WDC Company [?], Chen Feng [?], and T. Hawes [?], and quantitative perspectives from L. Davison [?], Zhuang Wei [?], and Zeng Hong [?], while also consulting D.L. Blenkhorn [?], B.J. Jaworski [?], Qiu Junping [?], and J.R. Smith [?]. Ultimately, intelligence quantity, intelligence quality, and intelligence demand satisfaction were selected as performance measurement indicators. Intelligence quantity includes scope, scale, and type; intelligence quality includes objectivity, reliability, and comprehensiveness; intelligence demand satisfaction includes novelty, economy, timeliness, confidentiality, and usability.

3.1 Impact of Network Scale on Competitive Intelligence Performance

Network scale, also known as network accessibility, refers to the number of direct connections between a focal actor and other actors. Regarding how network scale affects information resource acquisition, V.P. Marsden and E. Karen [?] found that the more connections enterprises have with the outside world, the more likely they are to obtain growth and development opportunity information; R. Katila and G. Ahuja believed that network coverage is proportional to the probability of enterprises screening and selecting correct information [?]; J.N. Cummings noted that network member diversity can enhance knowledge richness [?]; M.A. Schilling and C.C. Phelps' research showed that many direct connections can improve information transmission speed and accuracy [?]; and T. Opsahl and V. Pankaj confirmed that broad network membership can reduce information acquisition costs.

This study argues that network scale affects intelligence performance in three main aspects: (1) large network scale can expand intelligence search breadth and improve enterprise intelligence abundance; (2) diverse network member types can expand enterprise intelligence vision, providing conditions for identifying high-quality intelligence; (3) large network member numbers facilitate enterprise intelligence complementarity and matching more complete intelligence maps. Therefore, this study posits that network scale positively affects competitive intelligence performance. Related research hypotheses and mechanism models are shown in Table 1 and Figure 2 [Figure 2: see original paper].

Table 1. Research Hypotheses on Network Scale Impacting Competitive Intelligence Performance

- Network scale positively affects enterprise competitive intelligence performance
- Network scale positively affects intelligence quantity
- Network scale positively affects intelligence quality
- Network scale positively affects intelligence demand satisfaction

3.2 Impact of Network Status on Competitive Intelligence Performance

Network status refers to the position a node occupies in the network. It is an important basis for network members to differentially occupy and structurally allocate resources. Centrality mainly includes degree centrality and betweenness centrality measures. Regarding network status impact on intelligence performance, this study examines two aspects:

(1) Impact of Degree Centrality on Intelligence Performance. Degree centrality measures the superiority of individual or organizational network status and social prestige. J. Glückler found that central enterprises have more opportunities to access high-quality intelligence [**?**]; M. Reinholdt believed that central nodes have the ability to quickly acquire, identify, and develop quality resources [**?**]; J.P. Berrou pointed out that to shape and strengthen their network status, central enterprises disseminate accurate and reliable information [**?**]; and S. Dong confirmed that highly central nodes (experts) have more discourse power in possessing and allocating knowledge resources [**?**]. In summary, high degree centrality means greater control and 支配权 over network intelligence resources.

This study argues degree centrality affects intelligence performance in three aspects: (1) enterprises with high degree centrality play expert or authoritative roles in networks, attracting many nodes to actively establish connections, thereby obtaining massive information beneficial for intelligence extraction; (2) occupying degree central positions means enterprises have power to constrain and influence other members' behavior, who will provide high-quality information out of respect for this authority; (3) strong information processing capabilities of degree-central positions ensure rapid identification and extraction of key intelligence.

(2) Impact of Betweenness Centrality on Intelligence Performance. Betweenness centrality measures individual or organizational ability to act as intermediaries. Strong betweenness centrality creates obvious "bridge" effects, providing more access to external information and enabling rapid integration of high-quality fresh information. R. Gulati found that occupying betweenness central positions brings better resources and information [?]; S.P. Borgatti, Tortoriello, M. Gebreeyesus, and E. Hernandez believed that betweenness central positions reduce information search costs and facilitate acquisition of high-value strategic intelligence; Bao Changhuo, Qin Tiehui, and Wang Zhijin also confirmed that betweenness central nodes control intelligence resource flow and direction, enhancing competitiveness by serving as intelligence acquisition intermediaries for more enterprises.

This study argues that "bridging" phenomena are inevitable in interpersonal intelligence networks. Betweenness centrality affects intelligence performance in two aspects: (1) occupying "bridge" positions makes enterprises information flow centers, obtaining large amounts of heterogeneous information; (2) strong information processing and absorption capabilities of betweenness-central positions help screen and extract high-quality intelligence to meet work needs. However, "intermediary" status may also cause exhaustion, and any negligence could become a leakage point for important information. In summary, degree centrality and betweenness centrality each have their strengths. Specific research hypotheses and mechanism models are shown in Table 2 and Figure 3 [Figure 3: see original paper].

Table 2. Summary of Research Hypotheses on Network Status Impacting Competitive Intelligence Performance

- Network status affects enterprise competitive intelligence work performance
- Network status affects intelligence quantity
- Network status affects intelligence quality
- Network status affects intelligence demand satisfaction

3.3 Impact of Network Density on Competitive Intelligence Performance

This study argues network density affects intelligence performance in three aspects: (1) high network density means frequent member interaction, indicating large quantities and fast flow of intelligence within the network; (2) in high-density networks, members trust each other and have close relationships, exchanging and transmitting true and reliable information during resource exchange; (3) high network density means deep emotional bonds and strong reciprocity, with members striving to meet enterprise intelligence demands. However, cohesive networks may trap enterprises in "closed-loop" states, making it difficult to absorb fresh external information. Overall, the benefits outweigh the drawbacks. Specific hypotheses and related mechanisms are shown in Table

3 and Figure 4 [Figure 4: see original paper].

Table 3. Summary of Research Hypotheses on Network Density Impacting Competitive Intelligence Performance

- Network density positively affects competitive intelligence work performance
- Network density positively affects intelligence quantity
- Network density positively affects intelligence quality
- Network density positively affects intelligence demand satisfaction

4. Empirical Analysis of Structural Embeddedness Impacting Competitive Intelligence Work

To test relevant research hypotheses and conceptual models, this study surveyed domestic enterprises that understand and conduct competitive intelligence work. Through large-sample analysis and model fitting, testing, and revision, the actual mechanisms through which structural embeddedness affects competitive intelligence work were obtained.

The empirical research methods and steps include: (1) using SPSS 19.0 to test questionnaire item design 合理性 through reliability and validity tests; (2) questionnaire distribution and collection, using EXCEL and SPSS for statistical analysis; (3) using AMOS 17.0 for structural equation model construction and fitting.

Model fitting indicators selected: x^2/df, AGFI, CFI, and RMSEA. If $2 < x^2/df < 5$, the model is acceptable; if $x^2/df \leq 2$, model fit is very good. AGFI is the adjusted goodness-of-fit index; if AGFI > 0.90, the model is acceptable. CFI is the comparative fit index; if CFI > 0.90, the model is acceptable (the closer to 1, the better). RMSEA is the root mean square error of approximation; if RMSEA < 0.10, fit is good; if < 0.05, very good; if < 0.01, excellent.

4.1 Reliability and Validity Tests

Before questionnaire distribution, reliability and validity tests were conducted. The reliability test results for structural embeddedness dimensions and intelligence performance measurement indicators are shown in Tables 4 and 5 .

Table 4. Reliability Test Results for Three Structural Embeddedness Dimensions

Dimension	Item	Item-Total Correlation	Cronbach' s α
Network Scale	D1. Enterprise competitive intelligence activities involve wide scope, connecting with various external information sources like suppliers, distributors, and government departments	0.849	0.886

Dimension	Item	Item-Total Correlation	Cronbach' s α
	D2. Enterprise has numerous external information sources, with at least 5-6 contacts in each category (suppliers, distributors, government) of various scales and types	0.774	

Dimension	Item	Item-Total Correlation	Cronbach' s α
	D3. Besides maintaining contact with existing partners, enterprise continuously makes new friends and actively expands its external information network	0.789	

Dimension	Item	Item-Total Correlation	Cronbach' s α
Network Status	D4. Enterprise is highly influential in external information network with good reputation; suppliers, distributors, and government units respect its opinions and suggestions	0.836	0.923

Dimension	Item	Item-Total Correlation	Cronbach’ s α
	D5. Enterprise has strong strength, is industry leader with authority and discourse power; many units are willing to communicate and cooperate	0.716	

Dimension	Item	Item-Total Correlation	Cronbach’ s α
	D6. Enterprise has wide connections, well-known in industry; often helps other enterprises connect with new partners	0.893	
	D7. Enterprise is a necessary pathway for communication among network members; exchanges cannot bypass it	0.788	

Dimension	Item	Item-Total Correlation	Cronbach' s α
Network Density	D8. Enterprise has connections with all members in external information network and interacts very frequently	0.825	0.924
	D9. Members in enterprise' s external information network communicate frequently and have close connections	0.776	

Dimension	Item	Item-Total Correlation	Cronbach' s α
	D10. Members outside the enterprise in the network have close relationships, strong trust, and deep emotions	0.808	

Table 5. Reliability Test Results for Intelligence Quantity

Dimension	Item	Item-Total Correlation	Cronbach' s α
Intelligence Quantity	B1. Enterprise' s intelligence collection scope is very broad; intelligence personnel collect from all external sources like government, research institutes, raw material suppliers, distributors, competitors	0.738	0.870

Dimension	Item	Item-Total Correlation	Cronbach' s α
	B2. Intelligence personnel can obtain large amounts of information about government, research institutes, raw material suppliers, distributors, competitors	0.816	

Dimension	Item	Item-Total Correlation	Cronbach' s α
	B3. Intelligence personnel can provide decision-makers with various types of information about competitive environment, competitors, and strategies in diverse formats	0.714	

The reliability test results show all item-total correlation coefficients exceed 0.35, and all variable Cronbach' s α coefficients exceed 0.70, indicating good internal consistency and strong reliability.

For validity testing, this study conducted content validity and construct validity tests. (1) Content validity: The questionnaire referenced classic designs in intelligence studies, revised and improved through field research and expert consultation, demonstrating good content validity. (2) Construct validity: Using AMOS for validity analysis through data and measurement model fitting, the structural embeddedness dimensions showed: $x^2/df = 2.05$ ($^2 = 22.017$, df = 11); AGFI > 0.90, CFI > 0.90, RMSEA = 0.080, with all path coefficients statistically significant. The intelligence performance measurement indicators showed: $x^2/df = 1.90$ ($^2 = 97.207$, df = 51), CFI > 0.90, AGFI = 0.871, RMSEA = 0.076, with all path coefficients statistically significant. Network scale, network status, and network density effectively measure structural embeddedness; intelligence quantity, quality, and demand satisfaction effectively measure intelligence performance. Results are shown in Tables 6 and 7 .

Table 6. Construct Validity Test Results for Three Structural Embeddedness Dimensions (N=156)

Fit Index	Value
Chi-square (^{2})	22.017
Degrees of freedom (df)	11
Goodness-of-fit index (GFI)	0.964
Adjusted goodness-of-fit index (AGFI)	0.907
Normed fit index (NFI)	0.960
Comparative fit index (CFI)	0.979
Chi-square/df (^{2}/df)	2.05
Root mean square error of approximation (RMSEA)	0.080

Table 7. Construct Validity Test Results for Intelligence Performance Measurement Model (N=156)

Path	Standardized Coefficient
Intelligence Objectivity ← Intelligence Quality	0.82
Intelligence Reliability ← Intelligence Quality	0.82
Intelligence Comprehensiveness ← Intelligence Quality	0.80
Intelligence Novelty ← Intelligence Demand Satisfaction	0.75
Intelligence Timeliness ← Intelligence Demand Satisfaction	0.82

Path	Standardized Coefficient
Intelligence Economy ← Intelligence Demand Satisfaction	0.82
Intelligence Confidentiality ← Intelligence Demand Satisfaction	0.82
Intelligence Targeting ← Intelligence Demand Satisfaction	0.82
Intelligence Utilization ← Intelligence Demand Satisfaction	0.82

4.2 Questionnaire Distribution and Data Collection

To minimize sample size impact on statistical analysis and obtain high-quality data, questionnaire distribution was controlled regarding enterprises, respondents, and channels. Nationwide, middle and senior managers from enterprises that understand and conduct competitive intelligence work were targeted. Distribution channels included: (1) on-site distribution at an international information systems conference held by IBM at the International Conference Center; (2) online questionnaire platform (URL: http://lilygirl.my.zhijizhibi.com/); (3) email distribution to all members through the China Competitive Intelligence Association; (4) distribution through personal contacts to competitive intelligence practitioners.

After completeness checks, 156 valid questionnaires were obtained. Sample distribution characteristics are shown in Figures 5 [Figure 5: see original paper], 6 [Figure 6: see original paper], 7 [Figure 7: see original paper], and 8 [Figure 8: see original paper].

Statistical results show the research covers enterprises across various industries, ownership types, and sizes, including management at all levels, comprehensively reflecting Chinese enterprise management’ s cognition of interpersonal intelligence network structural embeddedness.

4.3 Mechanism Model of Structural Embeddedness Impacting Competitive Intelligence Performance

Regarding structural embeddedness impact on competitive intelligence work, this study established an initial structural equation model. Through fitting analysis of relationships between structural embeddedness independent variables and intelligence performance dependent variables, the study examined, tested, and revised proposed hypotheses and conceptual models.

Testing proceeded in three progressive steps: (1) main effect analysis to determine whether structural embeddedness affects intelligence performance; (2) if yes, separate effect analysis to examine impacts of the three dimensions; (3) analysis of structural embeddedness impact on each intelligence performance factor.

4.3.1 Main Effect Analysis of Structural Embeddedness Impacting Competitive Intelligence Performance Main effect analysis examines model fit without considering relationships among independent variables, testing whether structural embeddedness and intelligence performance are related. If related, the research conclusion holds. Model fitting results are shown in Figure 9 [Figure 9: see original paper] and Table 8 .

Table 8. Model Fitting Results of Structural Embeddedness Impacting Intelligence Performance (N=156)

Parameter	Estimate	S.E.	C.R.	P	Beta
Intelligence Performance ← Structural Embeddedness	0.554	0.142	3.900	***	0.61

SMC Results: Estimate = 0.407

Initial SEM analysis results: ^{2} = 6.196, df = 8, x^2/df = 0.774 (<2), indicating excellent fit; AGFI = 0.967 (>0.90), acceptable; CFI = 1.000 (>0.90), excellent; RMSEA = 0.000 (<0.05), perfect fit. Additionally, the standardized regression coefficient (Beta) = 0.61, significant. The SMC value of 0.407 indicates structural embeddedness explains 40.7% of model variance, demonstrating significant impact on intelligence performance. Therefore, structural embeddedness positively and significantly affects intelligence performance.

4.3.2 Separate Effect Analysis of Three Structural Embeddedness Dimensions Separate effect analysis examines model fit considering relationships among independent variables, testing impacts of the three dimensions on intelligence performance. Results are shown in Figure 10 [Figure 10: see original paper] and Table 9 .

Table 9. Model Fitting Results of Structural Embeddedness Dimensions Impacting Intelligence Performance (N=156)

Path	Estimate	S.E.	C.R.	P
Intelligence Performance ← Network Scale	0.185	0.061	3.058	0.002
Intelligence Performance ← Network Status	0.078	0.061	1.288	0.198
Intelligence Performance ← Network Density	0.134	0.067	1.984	0.047

Model fit: ^{2} = 4.619, df = 6, x^2/df = 0.770 (<2), excellent; AGFI = 0.966 (>0.90), acceptable; CFI = 1.000 (>0.90), excellent; RMSEA = 0.000 (<0.05), perfect. Regression results show: network scale ($P = 0.002 < 0.05$) and network density ($P = 0.047 < 0.05$) significantly affect intelligence performance, while network status ($P = 0.198 > 0.05$) does not. Thus, all three dimensions affect intelligence performance, but network status's impact is less prominent. Ordered by influence: network scale, network density, and network status.

Regarding network status' s non-significant impact, this study argues that central nodes deliberately control intelligence resource flow to maintain their position and power. Additionally, considering reputation and professionalism, these nodes won' t release unverified key information, affecting intelligence performance.

4.3.3 Impact of Structural Embeddedness on Individual Intelligence Performance Factors This analysis examines model fit considering relationships among dependent variables, testing structural embeddedness impact on each intelligence performance indicator. Results are shown in Figure 11 [Figure 11: see original paper] and Table 10 .

Table 10. Model Fitting Results of Structural Embeddedness Impacting Intelligence Performance Factors (N=156)

Path	Estimate	S.E.	C.R.	P
Intelligence Quantity ← Structural Embeddedness	0.506	0.136	3.723	***
Intelligence Quality ← Structural Embeddedness	0.535	0.139	3.838	***
Intelligence Demand Satisfaction ← Structural Embeddedness	0.555	0.138	4.013	***

SMC Results: Intelligence Quantity = 0.142; Intelligence Quality = 0.167; Intelligence Demand Satisfaction = 0.186

Model fit: ^{2} = 5.051, df = 6, x^2/df = 0.842 (<2), excellent; AGFI = 0.964 (>0.90), acceptable; CFI = 1.000 (>0.90), excellent; RMSEA = 0.000 (<0.10), good. All paths show significant effects (***). Structural embeddedness has the strongest explanatory power for intelligence demand satisfaction (SMC = 0.186), followed by intelligence quality (0.167) and quantity (0.142), indicating differential impacts across indicators.

4.4 SEM Analysis of Structural Embeddedness Impacting Competitive Intelligence Performance

Through large-sample survey and SEM fitting analysis, research hypotheses were basically confirmed and conceptual models passed testing. Final conclusion: three structural embeddedness dimensions positively affect intelligence performance indicators, with network scale having the most significant impact on intelligence demand satisfaction. Hypothesis testing results are summarized in Table 11 .

Table 11. Summary of Hypothesis Testing Results

Hypothesis	Result
Network scale positively affects enterprise competitive intelligence work	Passed, positive
Network scale positively affects intelligence quantity	Passed, positive

Hypothesis	Result
Network scale positively affects intelligence quality	Passed, positive
Network scale positively affects intelligence demand satisfaction	Passed, positive
Network status affects enterprise competitive intelligence work	Passed, positive
Network status affects intelligence quantity	Passed, positive
Network status affects intelligence quality	Passed, positive
Network status affects intelligence demand satisfaction	Passed, positive
Network density positively affects enterprise competitive intelligence work	Passed, positive
Network density positively affects intelligence quantity	Passed, positive
Network density positively affects intelligence quality	Passed, positive
Network density positively affects intelligence demand satisfaction	Passed, positive

The validated mechanism model is shown in Figure 12 [Figure 12: see original paper].

5. Conclusions and Recommendations

This research provides construction strategies for enterprises seeking to enhance intelligence performance through structural embeddedness: (1) enterprises should widely establish relationships with intelligence sources, especially central nodes, as they have better access to key intelligence; (2) to ensure intelligence quantity and quality, structural embeddedness construction should avoid "insufficient effective embedding" and "excessive embedding" —the former creates loose connections and hinders important information exchange due to lack of trust, while the latter leads to "closed-loop" networks that cannot absorb fresh external information.

This study empirically reveals structural embeddedness mechanisms affecting intelligence performance, confirming that structural embeddedness is the lifeline of competitive intelligence work. Key intelligence acquisition and utilization significantly enhance enterprises' ability to obtain external resources, which is crucial for Chinese enterprises in economic transition needing to strengthen technical capabilities and knowledge stock. Network scale expansion and density increase can help achieve rapid agglomeration effects of external resources while reducing transaction costs. Many large Chinese enterprises have established competitive intelligence systems based on interpersonal networks, recognizing that rapid environmental changes require more than internal strength alone. Network centrality construction not only enhances environmental response capabilities but also strengthens competitive market position.

As a strategic architecture, intelligence network structural embeddedness construction can become a source of long-term competitive advantage with effective planning and systematic improvement. This study's investigation is particularly significant for Chinese manufacturing enterprises' intelligence network construction amid national advocacy for city clusters and industrial clusters to enhance regional economic competitiveness.

References

[1] HUGGINS R. Forms of network resource: knowledge access and the role of inter-firm networks [J]. International journal of management reviews, 2010, 12(3): 335-352.
[2] MCEVILY B, MARCUS A. Embedded ties and the acquisition of competitive capabilities [J]. Strategic management journal, 2005, 26(11): 1033-1055.
[3] FERNANDO A. Resource configuration, inter-firm networks, and organizational performance [J]. Mathematical social sciences, 2016, 82(3): 37-48.
[4] VASUDEVA G, ZAHEER A, HERNANDEZ E. The embeddedness of networks: institutions, structural holes, and innovativeness in the fuel cell industry [J]. Organization science, 2013, 24(3): 645-663.
[5] BERGER A. Small but powerful: six steps for conducting competitive intelligence successfully at a medium-sized firm [J]. Competitive intelligence review, 1997, 8(4): 75-84.
[6] DAVIES P N, KOZA M P. Eating soup with a fork: how informal social networks influence innovation in high-technology firms [J]. Strategic change, 2001, 10(2): 95-102.
[7] PRESCOTT J E, MILLER S H. Proven strategies in competitive intelligence: lessons from the trenches [J]. Competitive intelligence review, 2002, 12(2): 5-19.
[8] Bao Changhuo. Strengthening competitive intelligence work to improve Chinese enterprise competitiveness [J]. Information herald, 1998(11): 33-36.
[9] Qin Tiehui. Implications of embeddedness theory for intelligence research [J]. Library and information service, 2009, 53(24): 5-6, 20.
[10] JAWORSKI B J, MACINNIS D J, KOHLI A K. Generating competitive intelligence in organizations [J]. Journal of market-focused management, 2002, 5(4): 279-307.
[11] GILSING V, NOOTEBOOM B. Density and strength of ties in innovation networks: an analysis of multimedia and biotechnology [J]. European management reviews, 2005, 3(2): 179-197.
[12] SCHILLING M A, PHELPS C C. Interfirm collaboration networks: the impact of large-scale network structure on firm innovation [J]. Management science, 2007, 53(7): 1113-1126.
[13] UZZI B. A social network' s changing statistical properties and economic

performance [J]. Management and organization review, 2017, 13(2): 221-260.
[14] VASUDEVA G, ZAHEER A, HERNANDEZ E. The embeddedness of networks: institutions, structural holes, and innovativeness in the fuel cell industry [J]. Organization science, 2013, 24(3): 645-663.
[15] BURT R S, KATARZYNA B. Chinese entrepreneurs, social networks, and Guanxi [J]. Management and organization review, 2017, 13(2): 221-260.
[16] SIMMEL G. Soziologie: untersuchungen über die formen der vergesellschaftung [M]. Berlin: Duncker & Humblot Press, 1908.
[17] UZZI B. The dynamics of organizational networks: structural embeddedness and economic behavior [D]. New York: State University of New York at Stony Brook, 1993.
[18] ZUKIN S, DIMAGGIO P. Structures of capital: the social organization of the economy [M]. Cambridge: Cambridge University Press, 1990.
[19] SHAN W, WALKER G, KOGUT B. Interfirm cooperation and startup innovation in the biotechnology industry [J]. Strategic management journal, 1994, 15(5): 387-394.
[20] POWELL W, KOPUT K, SMITH D. Interorganizational collaboration and the locus of innovation: networks of learning in biotechnology [J]. Administrative science quarterly, 1996, 41(1): 116-145.
[21] GNYAWALI D, MADHAVAN R. Cooperative networks and competitive dynamics: a structural embeddedness perspective [J]. Academy of management review, 2001, 26(3): 431-445.
[22] JULIE M H, WILLIAM S H. The evolution of firm networks, from emergence to early growth of the firm [J]. Strategic management journal, 2001, 22(3): 275-286.
[23] HERRING J P. The role of intelligence in formulating strategy [J]. Journal of business strategy, 1992, 13(5): 103-109.
[24] FULD L. Measuring the value of competitive intelligence: the inequities of return-on-investment calculations [EB/OL]. [2019-12-20]. http://www.fuld.com.
[25] The Aurora WDC 2004 enterprise competitive intelligence software portals review [EB/OL]. [2019-05-20]. http://www.AuroraWDC.com.
[26] Chen Feng. Enterprise competitive intelligence work evaluation methods [J]. Library and information service, 2011, 55(20): 56-58.
[27] HAWES T A. Performance review for competitive intelligence [EB/OL]. [2019-12-15]. http://www.jthawes.com.
[28] DAVISON L. Measuring competitive intelligence effectiveness: insights from the advertising industry [J]. Competitive intelligence review, 2001, 12(4): 25-38.
[29] Zhuang Wei. My view on competitive intelligence utility evaluation [J]. Intelligence magazine, 2004, 23(6): 51-55.
[30] Zeng Hong. Competitive intelligence and intelligence competitiveness [J]. China management informationization (comprehensive edition), 2005(10): 62-64.
[31] BLENKHORN D L, FLEISHER C S. Managing frontiers in competitive intelligence [M]. Westport: Quorum Books Publication, 2001.

[32] JAWORSKI B J, MACINNIS D J, KOHLI A K. Generating competitive intelligence in organizations [J]. Journal of market-focused management, 2002, 5(4): 279-307.
[33] Qiu Junping, Zhang Rui. Enterprise competitive intelligence system benefit evaluation analysis [J]. Information science, 2004, 22(6): 649-652.
[34] SMITH J R, WRIGHT S, PICKTON D. Competitive intelligence programmes for SMEs in France: evidence of changing attitudes [J]. Journal of strategic marketing, 2010, 18(7): 523-536.
[35] MARSDEN P V, KAREN E. Measuring tie strength [J]. Social forces, 1984, 63(2): 482-501.
[36] KATILA R, AHUJA G. Something old, something new: a longitudinal study of search behavior and new product introduction [J]. Academy of management journal, 2002, 45(6): 1183-1194.
[37] CUMMINGS J N. Work groups, structural diversity, and knowledge sharing in a global organization [J]. Management science, 2004, 50(3): 352-364.
[38] SCHILLING M A, PHELPS C C. Interfirm collaboration networks: the impact of large-scale network structure on firm innovation [J]. Management science, 2007, 53(7): 1113-1126.
[39] GLÜCKLER J. Making embeddedness work: social practice institutions in foreign consulting markets [J]. Environment and planning, 2005, 37(10): 1727-1750.
[40] REINHOLT M, PEDERSEN T F O S N J. Why a central network position isn' t enough: the role of motivation and ability for knowledge sharing in employee networks [J]. The academy of management journal, 2011, 54(6): 1277-1297.
[41] BERROU J P, COMBARNOUS F. The personal networks of entrepreneurs in an informal African urban economy: does the 'strength of ties' matter? [J]. Review of social economy, 2012, 70(1): 1-21.
[42] DONG S, JOHAR M, KUMAR R. Understanding key issues in designing and using knowledge flow networks: an optimization-based managerial benchmarking approach [J]. Decision support systems, 2012, 53(3): 646-659.
[43] GULATI R, NOHRIA N, ZAHEER A. Strategic networks [J]. Strategic management journal, 2000, 21(3): 203-215.
[44] SCOTT J. Trend report: social network analysis [J]. Sociology, 1988, 22(1): 109-127.
[45] BURT R S, JANNOTTA J E, MAHONEY J T. Personality correlates of structural holes [J]. Social networks, 1998, 20(1): 63-87.
[46] COLEMAN J S. Foundations of social theory [M]. Cambridge: Harvard University Press, 1990.
[47] VALENTE T W. Network models of the diffusion of innovations [M]. New York: Hampton Press, 1995.
[48] SAXENIAN A. Regional advantage: culture and competition in Silicon Valley and route 128 [M]. Cambridge: Harvard University Press, 1994.
[49] RIGBY J, EDLER J. Creativity and cultural expressions in Africa and the African diaspora [J]. Research policy, 2005, 34(6): 784-794.
[50] KARAMANOS A. The effects of knowledge from collaborations on the

exploitative and exploratory innovation output of Greek SMEs [J]. Management dynamics in the knowledge economy journal, 2015, 3(3): 361-380.

Author Contributions

Tong Lijuan: Conceptualized research, designed methodology, and wrote manuscript
Tong Ruobei: Collected and analyzed data
Zhang Jianlin: Provided revision suggestions
Li Huan: Provided revision suggestions

Note: Figure translations are in progress. See original paper for figures.