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DEVELOPMENT OF THE STIM-G COMPETENCY SCALE FOR SCIENCE AND TECHNOLOGY INDUSTRY ORGANIZATIONAL TALENTS UNDER THE GREAT CHANGES: AN EMPIRICAL TEST BASED ON THE YANGTZE RIVER DELTA SCIENCE AND INNOVATION ECOSYSTEM AND THE AI-LINK PLATFORM

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ABSTRACT

Against the dual backdrop of generative artificial intelligence (GenAI) comprehensively reshaping business forms and highly volatile global geopolitics (e.g., technological decoupling, entity lists), building deep connections between academia and industry relying on digital intelligence infrastructures such as the "AI-Link" platform has become a matter of life and death for Chinese science and technology enterprises. However, the current evaluation system for compound talents is deeply trapped in the path dependence of traditional Western business education, failing to reflect the localized era demands of"digital-intelligence collaboration" and "geopolitical games". This study aims to break this limitation and explore the construction of an "independent knowledge system" for science and technology business studies with Chinese characteristics. Focusing on the highly scarce organizational talents in the science and technology industry, this study introduces the Upper Echelons Theory and Geopolitical Risk Theory, constructs and validates the STIM-G (Science, Technology, Innovation, Management, Global Geopolitics) competency model containing 5 dimensions and 20 concise items through grounded analysis of multi-source data, including in-depth interviews with 21 core industry practitioners and public speeches by AI-Link platform builders. Based on 304 valid samples of enterprise executives in the Yangtze River Delta region, initial dimension exploration via principal component analysis (N_1=128) and confirmatory factor analysis (N_2=176) were conducted in stages. The empirical results show that the refined scale has excellent reliability and validity (χ^2/df = 1.88, CFI = 0.96). Cross-group comparison confirms that the ability to navigate great power game sanctions and the ability to use AI-Link for cross-border integration are the core differentiating competencies distinguishing the new generation of science and technology leaders from traditional managers. This study provides a standardized quantitative tool for the evaluation of science and innovation talents and the reconstruction of new business education under the great changes.

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INTRODUCTION

Currently, the world is at a historical intersection of drastic technological changes and profound geopolitical restructuring. On the one hand, digital intelligence infrastructures represented by large models and the AI-Link data middle platform—a self-developed industry-university-research collaboration platform that interconnects scientific research data, patent resources and industrial demands — are greatly shortening the cycle from basic scientific research to industrial transformation; on the other hand, geopolitical conflicts (e.g., Sino-U.S. technological frictions, regional supply chain bloc formation) occur frequently. When Chinese hard technology enterprises go global, they no longer face only free market competition in the sense of classical economics, but long-arm jurisdiction and entity list sanctions under great power games. Chinese firms have responded by forging

collective innovation networks to navigate these export controls (Cai et al., 2026), which in turn places higher and more compound requirements on the competency of organizational talents in science and technology enterprises. In this dual-track environment intertwined with "digital intelligence" and "geopolitical crises", the traditional business administration talent model shows serious era lag. Deeply attached to the underlying assumptions of Western neoliberal market economy, traditional talent models excel at financial optimization in deterministic environments, but generally lack digital intelligence acumen to master underlying hard technologies and geopolitical awareness. Although the education community calls for cultivating compound talents who "understand science and technology, industry, capital, market, and management", the academic community lacks a clear definition of their underlying characteristics.

There is an urgent need to break the path dependence on Western business paradigms and construct an "independent knowledge system" for science and technology business studies with Chinese characteristics. This system refers to a theoretical paradigm rooted in China's local innovation practice, with independent theoretical premises, core concepts and methodological systems, rather than simply copying Western business theories. As the region with the highest degree of opening-up, the most complete science and innovation ecosystem, and the most frontline impact of international technological decoupling in China, the talent transformation practice in the Yangtze River Delta has strong national representativeness and forward-looking significance. Based on this, this study takes the Yangtze River Delta as a typical observation window and aims to answer: What are the core competency dimensions of science and technology industry organizational talents under the intertwining of digital intelligence transformation and geopolitical conflicts? How to develop a highly reliable and valid scale (STIM-G) to evaluate this new type of compound capability?

Theoretical Basis and Literature Review

Upper Echelons Theory, Dynamic Capabilities and Boundary Spanning Based on AI-Link: The Upper Echelons Theory indicates that managers' cognitive heterogeneity dominates enterprises' strategic choices (Hambrick & Mason, 1984). With the explosion of generative AI, recent studies point out that managers' core cognition must evolve toward "human-machine collaboration" (Automation-Augmentation) (Raisch & Krakowski, 2021). Especially in the uncertain technological revolution cycle, science and technology leading talents need to possess high-level digital dynamic capabilities to quickly sense, capture and reconstruct digital intelligence resources (Petricevic & Teece, 2019).

In this new innovation management paradigm, digital intelligence infrastructures (such as the AI-Link data middle platform) are no longer just technical tools, but act as super "boundary objects" (Nambisan et al., 2019; Carlile, 2004). Traditional industry-university-research collaboration is often constrained by knowledge barriers and information asymmetry, while the new generation of science and technology talents must have the ability to use AI-Link to penetrate underlying scientific research data and agilely connect industrial demands, thereby realizing knowledge integration across organizational and disciplinary boundaries in complex ecosystems (Yoo et al., 2012).

Geopolitical Risk (GPR) and Localized Reconstruction of Global Competency: The "global competency" model in traditional international business (IB) literature has long been dominated by Western context, with its core presupposition of a "flat world" and free market competition, excessively focusing on cross-cultural communication and gradual transnational operational adjustments (Wang et al., 2026). However, with the surging wave of de-globalization in recent years (Witt, 2019), Geopolitical Risk (GPR) has replaced traditional market risks as the primary threat to the survival of multinational enterprises (Moura et al., 2025). Recent top journal literature points out that in the face of "technological decoupling" and "long-arm jurisdiction", enterprises in emerging economies face a serious "geopolitical liability of foreignness" (Petricevic & Teece, 2019). The global layout of Chinese hard technology enterprises is directly exposed to the fire of entity lists and supply chain bloc formation. Therefore, based on the breakthrough practice of Chinese enterprises, completely copying the Western competency model emphasizing "institutional arbitrage" has become invalid (Luo & Van Assche, 2023). This study argues that it is necessary to separately list and strengthen the "Global & Geopolitical" dimension in the talent model, and regards the ability to navigate great power game sanctions and maintain the resilience of science and technology supply chains as the core capabilities of the new generation of talents. From the perspective of the Upper Echelons Theory, this geopolitical response capability essentially reflects the cognitive heterogeneity of executives, which directly determines the strategic choices and survival probability of technology multinational enterprises.

Qualitative Construction of STIM-G Dimensions and Item Refinement: This study adopts grounded theory and introduces a multi-source data triangulation strategy. Data collection combines "first-hand interviews + second-hand authoritative texts": on the one hand, 21 representative respondents in the core area of the Yangtze River Delta (including founders of hard technology enterprises that have broken through overseas sanctions, transnational technology VCs, etc.) were selected for in-depth behavioral event interviews; on the other hand, to accurately depict the reshaping effect of the new digital intelligence infrastructures, public lectures and keynote speeches by core construction leaders of AI-Link platforms such as the School of Science and Technology Business of the University of Science and Technology of China were specially collected, recorded and sorted out. Nvivo 14 software was used for joint analysis and three-level coding of more than 300,000 words of multi-source texts. To avoid "respondent fatigue" among executives, 12 experts including innovation management scholars and senior hard technology executives were invited for a two-round Delphi survey. The expert authority coefficient reached 0.87, and the Kendall's coefficient of concordance was statistically significant ($p<0.05$), indicating a high level of expert consensus on item selection. Following the principle of duplication removal and conciseness, the initial 40 items were reduced to 20 final items (4 items per dimension).

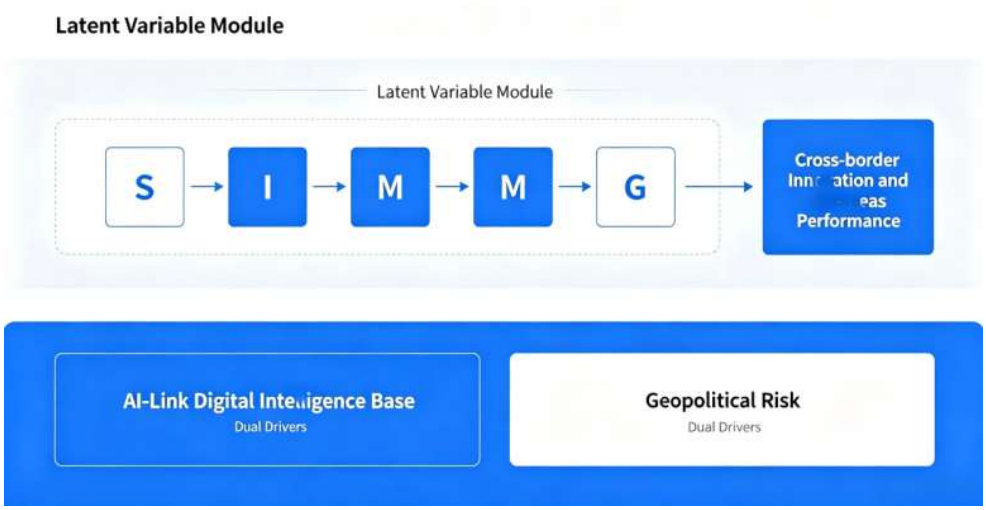

Figure 1. Theoretical Framework and Conceptual Model of STIM-G

Guided by the Upper Echelons Theory, Dynamic Capabilities Theory and Geopolitical Risk Theory, the five core competency dimensions are extracted through grounded analysis: specifically, Digital Intelligence and Technology Literacy (S) and Innovation and Engineering Transformation (I) are rooted in the perspective of digital dynamic capabilities and boundary spanning; Capital Market Closed-loop (M-Cap) and Agile and Flexible Management (M-Mgt) are based on the cognitive heterogeneity logic of the Upper Echelons Theory; Global Geopolitical Competence (G) is derived from the Geopolitical Risk Theory framework and also supported by the cognitive heterogeneity logic of the Upper Echelons Theory. The acronym STIM-G derives from five core conceptual domains: Science, Technology, Innovation, Management, and Global Geopolitics. Empirically, Science and Technology converge into one latent factor (Digital Intelligence and Technology Literacy, Factor S), while the Management domain is decomposed into two distinct dimensions (M-Cap and M-Mgt). The final model thus includes five stable latent variables, as verified through initial dimension exploration and confirmatory factor analysis.

The five extracted core dimensions are defined as follows:

- ***Digital Intelligence and Technology Literacy (S)****:*Refers to the ability to use digital intelligence infrastructures such as AI-Link to penetrate scientific research papers and predict technological inflection points.
- ***Innovation and Engineering Transformation (I)****:* Refers to the ability to use digital twin simulation to cross the "valley of death" and lead lean manufacturing upgrading.
- ***Capital Market Closed-loop (M-Cap)****:* Refers to the ability to realize hard technology capital valuation and market matching relying on algorithm insights.
- ***Agile and Flexible Management (M-Mgt)****:* Refers to the ability to maintain organizational resilience and exercise human-machine collaborative leadership under extreme uncertainty.
- ***Global Geopolitical Competence (G)****:* Refers to the ability to possess profound geopolitical awareness, calmly respond to entity list reviews and ensure supply chain security.

Data Collection and Initial Dimension Exploration: **This study adopted snowball sampling to distribute questionnaires to executives of science and technology enterprises in the Yangtze River Delta, and 128 valid samples were recovered in the first stage (N_1=128).**

Item Analysis: The critical ratio (CR) method was used to test the items. Independent samples **t**-test showed that all 20 retained items reached statistical significance (14 items at $p<0.001$, 4 items at $p<0.01$, and 2 items at $p<0.05$). The correlation coefficients between each item and the total score ranged from 0.45 to 0.76, indicating that the pre-test scale has true sample variability and good discrimination.

Results of Initial Dimension Exploration: The KMO value of the data was 0.892, and the approximate chi-square value of Bartlett's test of sphericity was 1945.82 ($p < 0.001$). Principal component analysis was adopted for initial dimension exploration with varimax orthogonal rotation, the eigenvalues of the 5 factors were all greater than 1, and the cumulative variance contribution rate reached 75.62%. The loadings of all items on their respective factors ranged from 0.71 to 0.84, with no cross-loadings, proving that the structure of the 20-item version is very stable.

Scale Validation with CFA and Cross-Group Analysis: For the second stage of independent executive samples, 176 valid questionnaires were recovered (N_2=176), including 111 executives of technology globalization enterprises and 65 executives of traditional manufacturing enterprises. Enterprises with overseas business layout and exposure to cross-border geopolitical risks are defined as technology globalization enterprises.

Model Fit and Reliability and Validity Test: *Harman's single-factor test was conducted on the CFA sample (N_2=176) to examine potential common method bias. The results showed that the first unrotated factor accounted for 32.47% of the total variance, which is below the critical threshold of 40%, indicating no serious common method bias in the sample data.* AMOS 26.0 was used to construct a Structural Equation Model (SEM). The fit indices of this 5-factor 20-item model were excellent: χ^2/df = 1.88, RMSEA = 0.045, CFI = 0.96, TLI = 0.95.

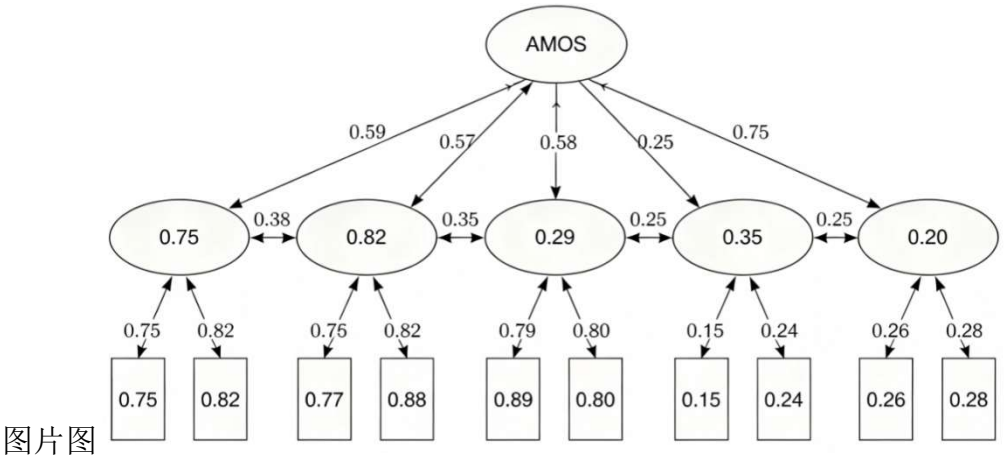

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Figure 2. Standardized Path Coefficients of Confirmatory Factor Analysis (CFA)

Table 1. Reliability and Convergent Validity Test Results of the 20-Item STIM-G Scale (N_2 = 176)

Core Competency Dimension	Number of Items	Factor Loading Range	Cronbach's α	CR	AVE
Global Geopolitical Competence(G)	4	0.78~0.88	0.93	0.93	0.72
Digital Intelligence and Technology Literacy(S)	4	0.72~0.85	0.87	0.88	0.63
Agile and Flexible Management(M-Mgt)	4	0.75~0.86	0.91	0.92	0.69
Innovation and Engineering Transformation(I)	4	0.73~0.84	0.89	0.89	0.65
Capital Market Closed-loop(M-Cap)	4	0.71~0.81	0.85	0.86	0.58

The dimensions show satisfactory convergent validity (as shown in Table 1). No cross-loadings were observed in the initial dimension exploration, which offers preliminary clues for good construct discriminability.

Table 2. Difference Test of Core STIM-G Dimensions Between TechGlobalization Executives and Traditional Manufacturing Executives

Core Competency Dimension	Tech Globalization Group(N=111)M(SD)	Traditional Manufacturing Group(N=65)M(SD)	Mean Difference	*t*	*p*
Global Geopolitical Competence(G)	4.38 (0.58)	3.15 (0.82)	1.23	11.64	<0.001***
Digital Intelligence and Technology Literacy(S)	4.12 (0.64)	3.42 (0.76)	0.70	6.42	<0.001***
Agile and Flexible Management(M-Mgt)	4.05 (0.68)	3.68 (0.72)	0.37	3.38	<0.01**
Innovation and Engineering Transformation(I)	4.15 (0.62)	3.92 (0.66)	0.23	2.30	<0.05*
Capital Market Closed-loop(M-Cap)	3.98 (0.75)	3.75 (0.80)	0.23	1.93	0.056(ns)

Note: ***p<0.001, **p<0.01, *$p<0.05$, *ns indicates not significant ($p>0.05$).*

Cross-Group Comparison Analysis (Empirical Test of Known-groups Validity): According to the theoretical framework, executives of technology globalization enterprises are directly exposed to geopolitical risks and deep digital transformation scenarios, so their STIM-G competency should be significantly higher than that of traditional manufacturing executives. To provide evidence of construct validity, a known-groups validation was conducted via independent samples t-test.

In-depth Empirical Analysis*:* The data in Table 2 objectively presents the real state of the industrial structure in the Yangtze River Delta. In terms of"Global Geopolitical Competence (G)", the technology globalization group has an absolute advantage over the traditional manufacturing group, indicating that responding to entity lists is the core competitive advantage of science and innovation talents. However, the difference between the two groups in "Innovation and Engineering Transformation (I)" is only significant at the 0.05 level, and there is no statistical difference in "Capital Market Closed-loop (M-Cap)". This result is highly consistent with the reality that the Yangtze River Delta has world-class traditional mass production experience. This consistently supports that the core differentiating factor of the independently constructed new generation of science and technology talent model lies not in the conventional capital operation capabilities emphasized by Western business studies, but in the mastery of cutting-edge digital intelligence infrastructures and geopolitical games. The above results are consistent with theoretical expectations, providing solid evidence for the construct validity of the STIM-G scale.

Conclusions, Practical Implications and Future Prospects

Research Conclusions and Theoretical Contributions: Based on the empirical evidence from the high-growth science and innovation clusters in the Yangtze River Delta, this study successfully constructed the STIM-G scale that takes into account both

digital intelligence transformation and geopolitical resilience. This study not only has application value, but also makes the following contributions to promoting the innovation of management theory:

First, it expands the theories of "boundary spanning" and "digital dynamic capabilities". It demonstrates that AI-Link is transforming into a super boundary object, and the essence of compound talents has evolved into high-level boundary spanners with human-machine collaboration capabilities.

Second, it introduces "Geopolitical Risk (GPR)" into the micro executive evaluation model. It extends geopolitical risk research from the macro and firm level to the micro individual executive evaluation level and defines the key micro defense line of science and technology leaders in supply chain security and entity list breakthrough under great power games.

Third, it substantially promotes the construction of the "independent knowledge system" of science and technology business studies (core contribution). For a long time, the evaluation of business talents in China has been deeply attached to Western theoretical presuppositions based on "neoliberalism" and a "flat world". This study breaks this path dependence, extracts the STIM-G construct deeply endogenous to China's science and innovation ecosystem based on the real great power game constraints faced by Chinese enterprises and the independently constructed digital intelligence infrastructures (AI-Link). The empirical comparison results (Table 2) strongly prove that the core differentiating competencies between the new generation of tech leaders and traditional managers are not the conventional capital operation capabilities advocated by classic Western MBA programs, but Global Geopolitical Competence and Digital Intelligence and Technology Literacy. This conclusion provides a solid quantitative basis for the localization and "de-Western-centrism" of science and technology business theory, and provides a standardized measurement tool for constructing an independent knowledge system of management with Chinese characteristics.

Implications for Educational Reform of the "Independent Knowledge System" of Science and Technology Business Studies: Constructing an independent knowledge system of philosophy and social sciences with Chinese characteristics, when implemented in science and technology business education, means that we must break the underlying dependence on traditional Western business studies. This scale provides a "break and build simultaneously" reconstruction guide for university entities testing the waters of business transformation:

Break path dependence and build practical simulations based on independent context*:* The construction of an independent knowledge system requires teaching content to directly face the real pain points of Chinese enterprises. We must completely break the copying of outdated free market cases from Western business schools, and separately set high-intensity practical modules based on China's national conditions of great power games, such as Response to Cross-border Long-arm Jurisdiction Under Technological Decoupling and Entity List Breakthrough and Global Supply Chain Restructuring**.**

Build on local innovation and reshape independent teaching paradigms with digital intelligence infrastructures*:* Theoretical independence must be supported by tool independence. The independently constructed "AI-Link data middle platform" should be directly introduced into the classroom as a teaching sandbox to accurately assess students' real transformation ability of using local AI algorithms to penetrate patents and avoid red lines for cross-border data export, so as to truly incubate five-dimensional STIM-G talents that fit China's local science and innovation ecosystem.

Limitations and Future Prospects: Although taking the Yangtze River Delta as a typical sample has strong forward-looking significance, the total sample size (N=304) still has room for expansion. In addition, the snowball sampling method may bring certain sample selection bias, and the generalizability of the scale needs further verification based on random sampling from more regions. Furthermore, this study adopts a cross-sectional research design, which can only reveal the correlation between variables rather than causal relationships. These limitations should be taken into account when interpreting and generalizing the research findings.

For future research, cross-regional validation can be conducted by introducing comparative samples from the Guangdong-Hong Kong-Macao Greater Bay Area and overseas Chinese-funded enterprises to further enrich the application scenarios of the independent knowledge system. Meanwhile, longitudinal tracking studies can be carried out to collect objective criteria such as the survival rate of enterprises after being sanctioned, so as to verify the long-term predictive validity of the STIM-G model and explore its dynamic impact on enterprise performance.

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