

Research on the Digital Transformation and Evaluation of Securities Firms: An Empirical Study in Southern China

Kunyu Li*

Dixie L. Leavitt School of Business, Southern Utah University, 351 W University Blvd. Cedar City Utah, 84720, the United States

Abstract. Digital transformation has emerged as a strategic imperative for Chinese securities industry. However, the degree of digital transformation among domestic securities firms lags behind other financial sectors, partly due to the absence of a systematic evaluation framework to guide and assess the transformation. This study constructs a tri-dimensional analytical system encompassing digital strategy, digital business, and digital governance. Utilizing Principal Component Analysis (PCA) to objectively weight transformation indicators, we quantify the digital transformation of securities firms in Southern China. The study reveals that while most securities companies have recognized the importance of digital transformation and formulated corresponding strategies, their implementation and post-transformation governance remain exploratory, impeding industry-wide progress. As the digital transformation of the securities industry advances, the evaluation framework requires continuous refinement. This research provides decision-making references for regulatory bodies, industry associations, and financial institutions, offering a foundation for securities companies to enhance digital transformation practices and governance systems.

1 Introduction

With the rapid development of science and technology, emerging economic models represented by the digital economy have exerted comprehensive impacts on global industries and human lifestyles in the background of the Fourth Industrial Revolution [1-3]. Following the 2023 Central Financial Work Conference in China, which emphasized five key financial priorities—technology finance, green finance, inclusive finance, elderly care finance, and digital finance—digitalization has been explicitly identified as a critical future direction for Chinese financial sector. Meanwhile, since 2013, the economic disparity between northern and southern China has gradually widened, characterized by a "faster growth in the south and slower growth in the north," now recognized as a prominent feature of China's regional economy. Digital finance can effectively influence this gap by reallocating financial resources [4].

* Corresponding author: kunyuli@suumail.net

The Research Report on Promoting Digital Transformation in the Securities Industry by the Securities Association of China states that advancing digital transformation is essential for the high-quality development of China's securities industry. Digital transformation will help securities companies reduce costs, enhance efficiency, and strengthen core competitiveness. By converting data into actionable production factors, digitalization enables direct interactions between enterprises and end-users, allowing firms to better understand user needs and mitigate the negative effects of geographical constraints [5, 6]. Additionally, digitalization improves corporate competitiveness, risk resilience, and dynamic risk monitoring capabilities [7, 8].

Although China's securities industry completed its informatization transformation earlier than other financial sectors, it has failed to lead the digital transformation of the financial industry amid the rise of digital industrialization and widespread adoption of digital technologies. In terms of capital investment and the advancement of digital financial services and products, the securities industry significantly lags behind banking and insurance [9]. Currently, China's securities industry is at a critical juncture for digital transformation. As a vital component of the financial sector, its digital transformation progress directly impacts the overall advancement, stability, and security of China's financial system.

Existing literature primarily employs three methods to quantify corporate digital transformation. First, textual analysis measures digital transformation by extracting the frequency of related keywords from annual reports [10, 11]. However, such indicators may be susceptible to corporate manipulation and often reflect strategic intentions rather than actual implementation. Second, intangible assets related to digital transformation are used as a metric [12]. Yet, this approach may underestimate transformation efforts, as digital initiatives also involve tangible asset investments. Third, quantitative statistical measures, such as Sun et al. [9], who pioneered quantitative research on securities companies' digital transformation. However, existing studies rely on subjective weight assignments based on experience, potentially compromising the objectivity of evaluation systems.

As digital transformation progresses, the securities industry urgently requires timely evaluations of its effectiveness to inform strategic adjustments. Thus, constructing a scientific, rational, and effective evaluation system is imperative. Addressing the limitations of existing research, this study focuses on theoretical exploration and evaluation system development for securities companies' digital transformation. Building on prior studies in banking, insurance companies, and securities companies, we propose a method for establishing an objective digital evaluation framework. By analyzing digital strategy, digital business, and digital governance, we assess the digital maturity of securities companies in southern China. This research provides decision-making references for financial regulators, industry associations, and institutions, supports securities companies in reshaping businesses through digital technologies, enhances fintech governance systems, and lays a robust foundation for evaluating future digital transformation in the securities industry.

2 Evaluation system for digital transformation of securities companies

Digital transformation in the financial sector is not merely the digitization of existing frameworks [3]. It encompasses products, transaction methods, business processes, departmental management, corporate operations, and strategic planning, representing a comprehensive overhaul of coordination and operational activities for financial enterprises [3, 13, 14]. Research on corporate digital transformation focuses on three dimensions: digital strategy, digital Business, and digital governance [6, 15]. Digital strategy serves as the foundation for corporate digital transformation, defining its direction, timeline, and intensity. Digital Business and digital governance reflect the execution and outcomes of digital

transformation, demonstrating the practical implementation of strategic plans. Additionally, digital business can enhance revenue generation and contribute positively to corporate development [16, 17]. However, while digitalization improves compliance and risk control, it also introduces new regulatory challenges such as fraud, data surveillance, privacy breaches, and legal risks. Thus, digital governance is a critical component of the digital transformation process for securities companies [3, 9]. To assess the current status of digital transformation in the securities industry, this study objectively evaluates securities companies in southern China based on three dimensions: digital strategy, digital business, and digital governance.

Digital Strategy refers to the extent to which securities companies prioritize digital technologies, measured through three secondary indicators: digital research and development (R&D) investment, digital strategy formulation, and digital transformation implementation. Firstly, digital R&D investment (IT investment) is sourced from annual reports, measured in RMB 10,000. The collected data are log-transformed after adding 1. Secondly, digital strategy formulation is a binary variable (1/0) determined by whether annual reports explicitly discuss digital development. By reviewing the annual reports published by securities companies, the digital strategy formulation variable is assigned a value of 1 if there are relevant discussions about digital development in the report, and 0 otherwise. Thirdly, digital transformation implementation is evaluated using the listed status of a company as an indicator. Securities companies that are publicly listed are assigned a value of 1, while those that are not assigned 0. By reviewing the IPO prospectuses of securities companies, it can be observed that one of the primary motivations for many securities firms to go public is to raise capital to advance digital development [9].

Digital Business refers to evaluating the integration of digital technologies into services, comprising three secondary indicators: digital R&D output, digital channel diversity, and digital talent pool.

Firstly, in terms of digital R&D output, this study quantifies the number of digital technology-related patents filed by securities companies between 2020 and 2023. The author retrieved and downloaded patent titles and abstracts of securities companies from the China National Intellectual Property Administration (CNIPA) for the period 2020–2023. Using 139 digital-related keywords extracted from the User Manual of the China Listed Companies' Digital Transformation Research Database (published by the CSMAR Database), the AI large language model DeepSeek was employed to match and identify patents containing these keywords or their derivatives. Subsequently, manual verification was conducted to confirm and tally the final count of digital technology-related patents. Secondly, the evaluation of digital channel diversity is based on whether securities companies provide three service platforms: PC software, mobile applications, and WeChat-based functionalities, with 1 point awarded for each operational channel. Thirdly, in terms of digital talent pool is measured by the number of IT professionals listed in annual reports, log-transformed after adding 1.

Digital Governance refers to dimensions including three secondary indicators: data standardization control, dynamic risk monitoring, and internal governance quality. Firstly, data standard control measures whether securities companies have established comprehensive standards for data governance and information disclosure. This metric employs the number of pages in annual reports as a proxy variable to quantify the company's information disclosure practices, which partially reflects the maturity of data standardization initiatives in securities firms [9]. Secondly, dynamic risk monitoring is a binary variable (1/0) indicating whether systems for identifying, monitoring, and alerting credit, market, operational, IT, compliance, and systemic risks are established. Thirdly, internal governance quality assesses the operational effectiveness of securities companies' digitally enabled risk control systems. This indicator is assigned a value of 1 if no new incidents of regulatory violations, litigation, or penalties occur during the fiscal year, indicating high-quality internal governance; otherwise, it is assigned 0.

Descriptive statistics of variables in the above three dimensions are shown in Table 1. In this table, digital R&D investment, digital R&D output, digital talent pool, and data standard control are variables continuous, and the rest are categorical variables.

Table 1. Descriptive statistics of indicators of digital transformation of securities companies

First-level indicators	Second-level indicators	Measurement	Mean	S.D.	Min	Max
Digital Strategy	Digital R&D Investment	Company's annual IT investment (logarithm)	9.89	1.70	0	12.85
	Digital Strategy Formulation	Presence of digital development discourse in annual reports (1/0)	0.68	0.47	0	1
	Digital Transformation Implementation	Listed status of the company (1/0)	0.43	0.50	0	1
Digital Business	Digital R&D Output	Total digital technology patents in 3 years (logarithm)	0.86	1.27	0	4.93
	Digital Channel Diversity	Service channels: PC software, mobile app, WeChat platform	2.60	0.53	1	3
	Digital Talent Pool	Number of IT professionals (logarithm)	4.92	1.44	0	8.09
Digital Governance	Data Standard Control	Number of annual report pages (logarithm)	4.68	1.02	2.99	6.16
	Dynamic Risk Monitoring	Whether the company has established a risk identification, monitoring, and early warning system (1/0)	0.52	0.50	0	1
	Internal Governance Quality	Whether the company incurred violations, litigation, or penalties during the year (1/0)	0.38	0.49	0	1

3 Calculation methodology of the evaluation system

3.1 Dimensionless normalization

The data used in this study were extracted from 2023 annual reports of securities companies published by the Securities Association of China. After excluding subsidiaries and firms with severe data deficiencies, 63 securities companies were included in the final index calculation. Given the diverse measurement units and scales across indicators, dimensionless normalization was applied prior to comparative analysis and aggregation [6]. The following transformation formula was implemented:

$$S_{i,j}^* = \frac{S_{i,j} - S_{j,l}}{S_{j,h} - S_{j,l}} \quad (1)$$

Where, $S_{i,j}$ denotes value of the securities company i on the indicator j , and $S_{i,j}^*$ denotes the normalized value. $S_{j,l}$ is the minimum observed value of the indicator j across 63 firms, and $S_{j,h}$ Maximum observed value of the indicator j .

3.2 Determining indicator weights

Maximum Prior to aggregating indicators, it is essential to assign appropriate weights. The Principal Component Analysis (PCA) method, widely adopted for its objectivity (e.g., [6, 18]), is employed here. As digital transformation remains an emerging field lacking mature

evaluation frameworks for empirical reference, PCA, which assigns factor weights based on intrinsic data characteristics, helps mitigate potential biases from subjective judgments.

Using Python's factor_analyzer library, the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity (with p-value < 0.05) were conducted on the selected indicators. The results showed a KMO value of 0.78 (exceeding the threshold of 0.5), indicating adequate sampling adequacy. Bartlett's test yielded a p-value of 2.2×10^{-70} , confirming significant correlations among variables and validating the suitability of PCA. The specific indicators and their derived weights are presented in Table 2.

Table 2. Weight of the indicators of digital transformation of commercial banks (PCA)

First-level indicators	Weight	Second-level indicators	Weight
Digital Strategy	33.82%	Digital R&D Investment	34.16%
		Digital Strategy Formulation	33.08%
		Digital Transformation Implementation	32.76%
Digital Business	32.38%	Digital R&D Output	34.74%
		Digital Channel Diversity	32.04%
		Digital Talent Pool	33.22%
Digital Governance	33.80%	Data Standard Control	36.17%
		Dynamic Risk Monitoring	37.24%
		Internal Governance Quality	26.59%

4 Analysis of digital transformation evaluation results for securities companies

4.1 Overall evaluation of digital transformation

This study evaluates the 2023 digital transformation progress of 63 securities companies in Southern China using the established evaluation system. The average total digital transformation score across all companies is 54.63, with a maximum score of 88, a minimum score of 9, and a variance of 24. As shown in Figure 1, scores are distributed across 10-point intervals. Among the companies, 26 (41.27%) scored 70 or above, while 29 (46.03%) scored below 50, indicating that nearly half of the companies are still in the initial or exploratory stages of digital transformation.

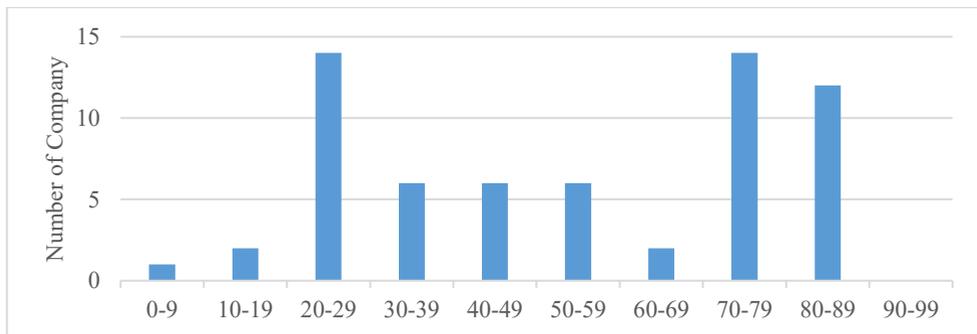


Fig. 1. Composite Score Ranges and Distribution in Digital Transformation (2023).

From the sub-indicator perspective (Figure 2), the average score for digital strategy is 62.92, higher than the composite average, reflecting companies' emphasis on strategic planning and investment. The average score for digital governance is 48.81, the lowest among the three sub-indicators, highlighting lagging governance systems. The average score for digital business slightly trails the composite average, suggesting insufficient integration of digital technologies into services.

Table 3 presents the top 10 companies by composite score. The top 10 achieve an average score of 85.4, 56.31% higher than the overall average. Their digital strategy scores an average of 96.10, with all companies explicitly outlining digital plans in annual reports and being listed. For digital business, the average score is 75.70, supported by 10,332 IT professionals, 186 digital patents (2020–2023), and 9 companies offering PC software, mobile apps, and WeChat-based services. In digital governance, the average score is 83.80, with all companies implementing risk management systems and 6 establishing standardized data governance frameworks. Huatai Securities, Industrial Securities, and Guotai Junan Securities rank top three, scoring 88, 88, and 86, respectively. Among all 63 companies, 28 (44.44%) scored above 60. While most prioritize digital strategy, challenges remain in IT staffing, R&D output, and governance maturity.

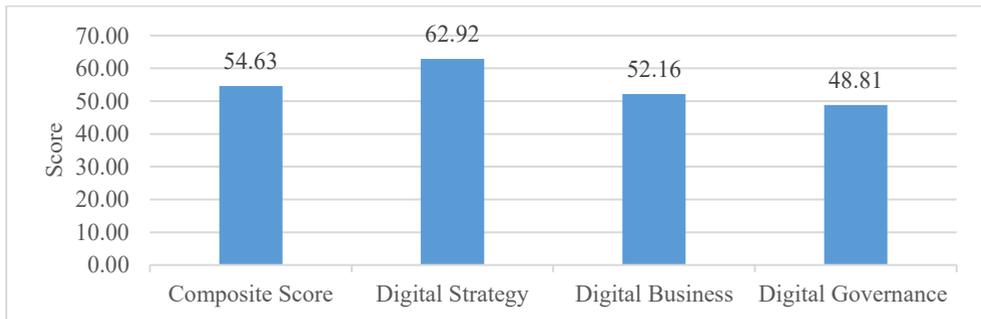


Fig. 2. Average Score of Digital transformation index (2023).

Table 3. Top 10 companies by the composite digital transformation score

Company name	Composite score ranking	Digital strategy ranking	Digital business ranking	Digital governance ranking	Composite score
Huatai Securities	1	2	1	13	88
Industrial Securities	2	8	6	7	88
Guotai Junan Securities	3	3	2	16	86
Huaan Securities	4	17	7	5	86
CITIC Securities	5	1	5	14	85
China Merchants Securities	6	5	17	3	85
GF Securities	7	6	4	20	84
Great Wall Securities	8	18	11	8	84
Nanjing Securities	9	24	12	9	84
Guojin Securities	10	12	15	6	84

4.2 Evaluation of digital strategy, business and governance

A scatter plot analysis (Figure 3) reveals the relationship between digital strategy scores and the composite digital transformation score. Digital strategy scores cluster in three ranges: 20–30, 50–70, and 90–100, reflecting three industry trends: (1) top-tier companies with comprehensive strategies and proactive implementation, (2) mid-tier firms with partial strategies and inconsistent execution, and (3) low performers lacking coherent strategies. Notably, 20 companies (31.75% of the sample) do not mention digital plans in annual reports, underscoring insufficient strategic prioritization.

Figure 4 shows the relationship between the digital business scores and the composite digital transformation score. Digital business scores are primarily concentrated in the 30–70 range, covering 55 companies (87.30%). This indicator exhibits the most uniform score distribution, indicating that nearly all securities companies actively develop digital business. Leading firms, such as Huatai Securities (ranked first in digital business), demonstrate advanced capabilities, with 46 digital-related patents filed over three years and 3,268 IT professionals accounting for 19.62% of their total workforce.

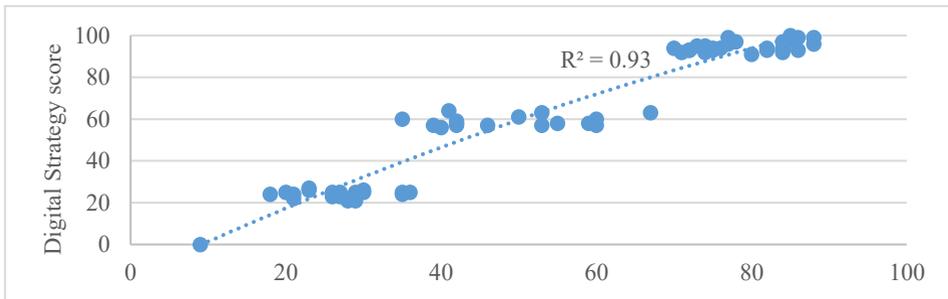


Fig. 3. Distribution of Digital Transformation Comprehensive (Horizontal Axis) and Digital Strategy (Vertical Axis) score.

Figure 5 displays the distribution of digital governance scores and the composite digital transformation score. Digital governance scores are divided into four distinct intervals: 0–20, 30–40, 60–80, and 90–100, reflecting significant disparities. This is the most polarized indicator, with top-tier companies generally exhibiting stronger governance practices. Specifically, to dynamic risk monitoring, 33 companies (52.38%) have established risk control systems, as disclosed in annual reports; to governance quality: 39 companies (61.90%) received administrative penalties, underscoring deficiencies in the effectiveness of digital risk management systems. These results emphasize that the securities industry still requires improvement in the development and quality of its digital risk control systems.

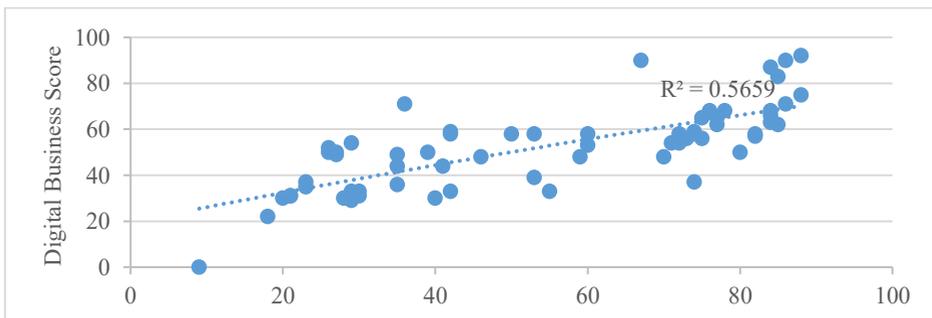


Fig. 4. Distribution of Digital Transformation Evaluation (Horizontal Axis) and Digital Business (Vertical Axis) score.

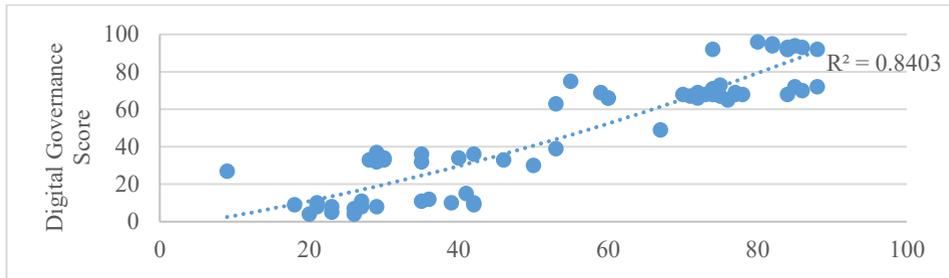


Fig. 5. Distribution of Digital Transformation Evaluation (Horizontal Axis) and Digital Governance (Vertical Axis) score

5 Conclusions and limitations

This study establishes a digital transformation evaluation system for securities companies based on three integrated dimensions—digital strategy, digital business, and digital governance—to assess the progress of 63 securities companies in southern China.

The findings reveal significant disparities in maturity across these dimensions, reflecting the industry's complex landscape. Over half of the companies recognize the urgency of digital transformation, with 43 firms (68.25%) explicitly outlining digital strategies in their 2023 annual reports, aligning with China's national focus on the "Five Key Financial Initiatives" and the strategic elevation of digital finance. While leading firms demonstrate proactive implementation of comprehensive strategies, many companies remain in exploratory phases, particularly in operational execution. For instance, top performers leverage substantial IT investments and patent portfolios (e.g., Huatai Securities with 46 digital patents and 3,268 IT professionals), whereas others struggle with fragmented initiatives or insufficient resource allocation.

The integration of digital technologies into business operations shows uneven progress. Most companies are still developing service channels and talent pools, though leaders excel in deploying tools like AI-driven platforms and multi-channel interfaces. Governance frameworks, however, exhibit the widest performance gaps. While a minority of firms have established robust risk management systems and standardized data practices, over 61.90% of companies faced regulatory penalties, underscoring systemic challenges in balancing innovation with compliance. These disparities highlight the dual pressures of leveraging digital opportunities while mitigating emerging risks, such as data privacy breaches and operational vulnerabilities.

Despite these insights, the study acknowledges limitations, such as incomplete data on leadership expertise in IT, which could further refine strategic assessments. Future research should expand this framework to address gaps and enhance its applicability across diverse market contexts.

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