A study on the impact of digital transformation on innovation in textile and apparel companies: evidence from the Chinese market

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ABSTRACT – REZUMAT

A study on the impact of digital transformation on innovation in textile and apparel companies: evidence from the Chinese market

This study analyses data from 2010 to 2022 concerning companies listed on the Chinese A-share market to evaluate the extent of digital transformation within textile and apparel companies. Utilising the entropy method and the TOPSIS technique, the research assesses the impact of digital transformation on investment in innovation, including research and experimental development. Empirical findings indicate that digital transformation in these companies correlates with an increase in innovation investment. A more effectively marketised environment enhances the positive effects of digital transformation on innovation in traditional companies. Heterogeneous studies demonstrate that firms in Eastern China and high-tech companies exhibit more significant positive impacts from digital transformation on innovation.

Keywords: *textile, apparel, company, digital, innovation*

Studiu privind impactul transformării digitale asupra inovării în întreprinderile din sectorul de textile și de îmbrăcăminte: dovezi de pe piața din China

Acest studiu analizează datele din perioada 2010–2022 referitoare la societățile cotate pe piața chineză a acțiunilor de tip A pentru a evalua amploarea transformării digitale în cadrul întreprinderilor din sectorul de textile și de îmbrăcăminte. Utilizând metoda entropiei și tehnica TOPSIS, cercetarea evaluează impactul transformării digitale asupra investițiilor în inovare, inclusiv cercetarea și dezvoltarea experimentală. Constatările empirice indică faptul că transformarea digitală în aceste întreprinderi este corelată cu o creștere a investițiilor în inovare. Un mediu marketizat mai eficient sporește efectele pozitive ale transformării digitale asupra inovării în întreprinderile tradiționale. Studiile eterogene demonstrează că firmele din estul Chinei și companiile de înaltă tehnologie prezintă efecte pozitive semnificative ale transformării digitale asupra inovării.

Cuvinte-cheie: *textile, îmbrăcăminte, companie, digital, inovare*

INTRODUCTION

Innovation serves as a critical catalyst for national economic enhancement and reform. The “Three-Year Action Plan for the Digital Transformation of the Textile Industry (2022–2024)”, issued by the China National Textile and Apparel Council in June 2022, underscores the imperative of amalgamating next-generation information technologies with the development of the textile industry. Prioritising intelligent manufacturing and focusing on the innovative applications of the industrial internet, the plan advocates for an accelerated digital transformation of the textile sector [1]. This study poses a critical inquiry: How does the extent of digital transformation within the textile and apparel industry affect organisational innovation? A significant challenge in this domain is the measurement of digital transformation. The prevalent method involves the use of survey data, as documented in existing literature; however, the subjective nature of this data may compromise the precision of the results. Additionally, the textile and apparel industry, being fully market-oriented with significant demand and low entry barriers, has proliferated across both economically advanced and less developed regions in China. This dispersion prompts another question: In the face of the twin challenges of digital transformation and corporate innovation, could regional disparities in marketisation influence the effect of digital transformation on textile and apparel firms, thereby either accelerating or impeding organisational innovation?

To address these questions, the current study analyses data spanning from 2010 to 2022 from textile and apparel companies listed on the Chinese A-share market. It evaluates the degree of digital transformation across two dimensions: business processes and technological applications. Furthermore, this research explores the relationship between organisational innovation and the extent of digital transformation, introducing a marketisation index as a moderating variable in this dynamic. The objective is to

provide novel insights that enhance the innovation capacities of textile and apparel enterprises and to highlight the pivotal role of digital transformation within the industry.

LITERATURE REVIEW AND RESEARCH HYPOTHESES

Digital transformation in the textile and apparel industry and company innovation

The correlation between digital transformation and innovation has been predominantly viewed positively within scholarly discourse, with numerous studies analysing the influence of digital transformation on innovation from diverse perspectives. In examining the specific dynamics between digital transformation and innovation within the textile and apparel industry, the analysis can be segmented into two core areas: management processes and product development processes within these companies. At the management level, many textile and apparel firms traditionally adhere to hierarchical, conventional management structures and rely on manual business processes, often resulting in unnecessary and redundant steps [2]. Digital transformation facilitates a shift towards a more horizontal management architecture, which enhances inter-departmental oversight, reduces opportunistic behaviours among executives, and increases their accountability regarding performance-based compensation [3]. This transformation enables managers to exert more comprehensive control over business operations and to integrate internal resources more effectively, thereby optimising corporate performance. Ultimately, this contributes to enhanced competitiveness and supports innovative decision-making that is crucial for long-term development [4]. Digital transformation fosters new paradigms of thought and operational models in traditional settings. Therefore, textile and apparel companies are encouraged to augment their investments in digital technologies and infrastructures and expedite technological advancements. The digital transformation process notably improves the functionality and integration of companies' ERP and CRM systems, thereby enhancing their service orientation [5].

At the product development level, digital transformation impacts three primary stages. Firstly, during product planning, digital technologies enable more accurate forecasting of fashion trends through meticulous data analysis, overcoming the limitations of traditional apparel planning, such as lengthy development cycles, high subjectivity, disregard for consumer demands, and slow responsiveness to market shifts. Secondly, in the product design phase, digital technology has evolved from two-dimensional clothing pattern design and layout to advanced three-dimensional digital technologies, which include precise human body measurement, modelling, clothing design, cutting, sewing, and virtual clothing displays [6]. Finally, in the marketing phase, textile and apparel companies utilise digital technologies for both online and offline marketing strategies, targeted marketing on new media platforms, and the creation of immersive digital experiences [7].

Collectively, digital transformation in textile and apparel companies leads to a better understanding of consumer demands, reduces the probability of product rejection, decreases inventory levels, and enhances cash flow. Consequently, it is plausible to assert that digital transformation fosters research and development (R&D) as well as innovation within companies, thereby increasing their R&D investments. Based on these considerations, the study proposes the following hypothesis:

H1: Digital transformation in textile and apparel companies positively influences R&D intensity.

Company innovation, digital transformation, and marketisation

Drawing upon new institutional economics, the institutional environment is recognised as an external determinant of technological innovation within companies. In this context, the innovation capabilities of textile and apparel companies engaged in digitalisation are shaped and limited by both internal and external factors. Furthermore, the progress of digital technology is influenced by the level of marketisation. From a supply perspective, enhanced marketisation catalyses the steady progression of digital technology, creating a supportive environment for innovation and supplying the necessary elements for its fruition. From a demand perspective, higher marketisation levels lead to wider applications of digital technology, with shifts in consumer demand prompting the evolution of the digital technology-related industrial chain [8].

In terms of the digital transformation of textile and apparel companies, addressing various application scenarios within the industrial sector is crucial. This involves establishing connections with a wide array of personnel, equipment, and systems across the industry – a substantial effort that demands collective action from all stakeholders. When considering all influencing factors, the market emerges as the ultimate determinant. The higher the level of marketisation and the more robust the market mechanisms, the broader the provision of external business environment information to companies. Moreover, higher marketisation levels enhance the effectiveness of incentives and oversight for executives. Thus, the digital transformation of textile and apparel companies is intrinsically linked to market-oriented strategies. Based on these considerations, the study proposes the following hypothesis:

H2: The level of marketisation positively moderates the relationship between digital transformation and R&D intensity in textile and apparel companies. The conceptual research framework proposed in this study is depicted in figure 1.

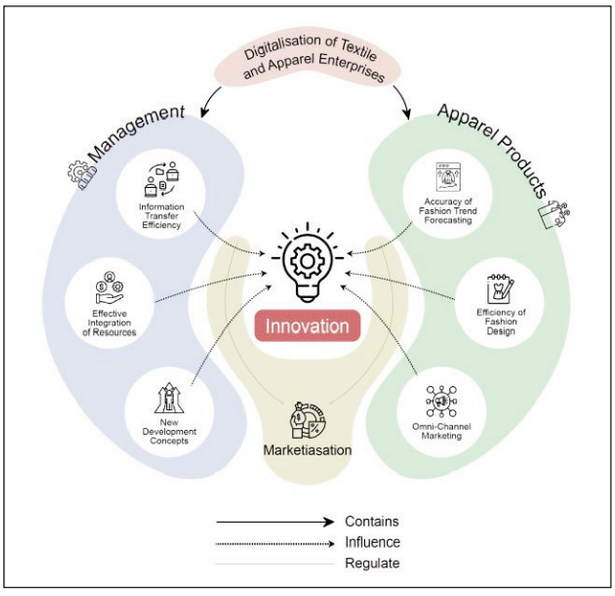

Fig. 1. Conceptual research framework

METHODOLOGY

Sample selection

This study focuses on textile and apparel companies listed on the China A-share stock exchange. To minimise the impact of missing data and errors, information is sourced from databases such as CSMAR and WIND, along with annual reports from Wallstcn.com. For instances of minor missing data for the same company across different years, the moving average method is employed to complete the dataset. To ensure a robust sample, the selection principle involves choosing data that covers an extended period. Given the digital development trajectory in the Chinese market, the selected sample period spans from 2010 to 2022. After excluding companies with abnormal financial conditions categorised under “PT” and “ST” designations, as well as those with missing data for key variables, the final research sample comprises 108 companies, amounting to 655 observations.

Variable description

Company innovation

In the extant literature, company innovation is frequently assessed using R&D intensity as a proxy for innovation input or patent counts to represent innovation output. Nevertheless, the use of patent data has its limitations as an indicator, since not all innovations result in patentable outputs, particularly in the context of Chinese textile and apparel companies, where a substantial proportion of imitative innovations may not yield patents [9]. While some studies incorporate both R&D expenditure and the number of R&D personnel to gauge innovation input, this approach can be problematic. Since R&D inputs include the salaries of R&D personnel, and the level of individual contribution varies, the salaries may serve as a more precise quantitative measure of innovation contributions. Therefore, this study posits that R&D inputs might represent a more accurate indicator of innovation input for textile and apparel companies. Furthermore, this study operationalises company innovation using R&D intensity (rd), defined as the ratio of R&D investment to total assets.

Digital transformation degree

This study employs the Entropy-Weighted TOPSIS method to measure the degree of digital transformation. The entropy weighting method is an objective approach that minimises the subjectivity in the weighting of evaluation indicators and facilitates an intuitive understanding of the efficacy of the information these indicators convey, aligning closely with practical requirements [10]. The TOPSIS (Technique for Order Preference by Similarity to an Ideal Solution) method evaluates a limited number of entities by ranking them based on their proximity to an ideal solution, offering a comparative assessment of their relative merits and demerits. The integration of these methods in the Entropy-Weighted TOPSIS approach is particularly suited for complex, multi-criteria decision-making scenarios, providing benefits such as high evaluative efficiency, scientific rigour, and practical applicability [11]. The adoption of the Entropy-Weighted TOPSIS method thus ensures a more objective and reasonable quantification of digital transformation in enterprises.

The degree of digital transformation is abbreviated as “digi”. Literature indicates that evaluating digital transformation should encompass four dimensions: strategic management, organisational culture, technology application, and business processes [12]. Challenges arise in gathering pertinent data concerning digital strategy at the level of strategic management, organisational structure within the cultural framework, and employee capabilities. Owing to these data constraints, the selected indicators for this dimension are the number of technical personnel and the efficiency of resource allocation [13]. The business process dimension comprises digital supply chain management, performance evaluation, and digital goods and services [14]. The evaluation system for assessing the degree of digital transformation in companies is detailed in table 1.

The entropy method determines the weight of each indicator, as illustrated in table 2. Following this, the TOPSIS method applies these weights to the normalised matrix, identifies the ideal positive and negative solutions, calculates the Euclidean distances, and computes the relative closeness to derive the evaluative score for digital transformation, which is then integrated into the model.

Control variables and moderating variables

Empirical research based on corporate financial data involves various variables. This study, drawing on key indicators from previous research on factors influencing corporate innovation and development, takes into account the unique characteristics of textile and apparel firms, such as significant differences in establishment periods and a stronger emphasis on market-driven factors [15]. Consequently, the study selects the following variables: company size (size),

Table 1

EVALUATION SYSTEM FOR THE DEGREE OF DIGITAL TRANSFORMATION			
Evaluation dimension		**Evaluation indicator**	**Indicator description**
Technology application level	Digital supply chain	Inventory optimization	The difference between the net inventory of the preceding year and the net inventory of the current year
	Performance evaluation	Cost control	Difference between the non-manufacturing costs of the preceding year and the non-manufacturing costs of the current year
Technology application level	Data-driven approaches	Number of Technical personnel	Total technical personnel at the end of the year
	Information system development	Resource allocation efficiency	Calculated using the DEA based on constant returns to scale

Table 2

WEIGHTS OF EVALUATION INDICATORS FOR DIGITAL TRANSFORMATION DEGREE				
Year	**Inventory optimisation (%)**	**Cost control (%)**	**Number of technical personnel (%)**	**Resource allocation efficiency (%)**
2010	3.42	4.87	56.73	34.98
2011	2.91	3.87	58.21	35.01
2012	3.26	5.28	54.81	36.65
2013	2.99	3.03	57.57	36.41
2014	3.48	4.18	50.34	42.00
2015	2.87	8.83	53.68	34.62
2016	5.13	3.22	57.16	34.49
2017	3.05	2.84	56.19	37.92
2018	4.51	3.74	57.16	34.59
2019	4.63	10.48	54.91	29.98
2020	5.02	7.52	55.34	32.12
2021	4.37	9.26	54.72	31.65
2022	4.83	8.71	58.16	28.30

return on assets (ROA), accounts receivable turnover ratio (REC), ownership proportion of the largest shareholder (Top), firm age (Firm Age), and the number of directors (Board). The marketisation index (market) functions as the moderating variable. This index quantifies the relative advancement of marketisation in Chinese provinces, autonomous regions, and municipalities directly under the central government. The foundational data for this index are derived from the National Bureau of Statistics, other relevant departments, and nationwide company surveys. This system comprises five dimensions, each represented by eighteen basic indicators, which include the relationship between the government and the market, the progression of the non-state economy, product market development, factor market development, the legal environment and the growth of market intermediary organisations. For the definitions and formulas of these variables, refer to table 3.

Model construction

Based on the fundamental method of model construction, this study incorporates all the aforementioned variables into the model to examine the impact of the degree of digital transformation on innovation in textile and apparel firms [16, 17]. The constructed model is as follows:

$$rd_{i,t} = \beta_1 Digi_{i,t} + \beta_2 Size_{i,t} + \beta_3 ROA_{i,t} + \beta_4 REC_{i,t} + \\ + \beta_5 Top_{i,t} + \beta_6 FirmAge_{i,t} + \beta_7 Board_{i,t} + \varepsilon_{i,t} \quad (1)$$

where i denotes the company; t is the year; $\varepsilon_{i,t}$ represents the error term, with Research and Development intensity (rd) as the dependent variable. The coefficient sign and magnitude of the term for digital transformation degree (digi) on the right side of the equation reflect the impact of digital transformation on R&D intensity and the investment in R&D personnel. Based on prior literature and hypotheses, we preliminarily speculate that this coefficient will be positive. To examine the moderating effect of the marketisation index (market), the following model is built, where X expresses the interaction term between digi and market after centralisation processing. Similarly, we preliminarily speculate that this coefficient will be positive:

$$rd_{i,t} = \beta_1 Market_{i,t} + \beta_2 Digi_{i,t} + \beta_3 X_{i,t} + \beta_4 Size_{i,t} + \\ + \beta_5 ROA_{i,t} + \beta_6 REC_{i,t} + \beta_7 Top_{i,t} + \beta_8 FirmAge_{i,t} + \\ + \beta_9 Board_{i,t} + \varepsilon_{i,t} \quad (2)$$

Table 3

VARIABLE DESCRIPTIONS AND CALCULATION FORMULAS			
Variable type	**Variable**	**Meaning**	**Variable description**
Dependent variable	Rd	R&D intensity	R&D expenditure / total assets
Independent variable	Digi	Digital transformation degree	Comprehensive evaluation value obtained through TOPSIS
Control variables	Size	Company size	Natural logarithm of total assets
	ROA	Return on assets	Net profit / average total assets
	REC	Accounts receivable turnover ratio	Ratio of net receivable to total assets
	Top	Ownership Proportion of the largest Shareholder	Proportion of shares held by the largest shareholder / total shares
	Firm age	Firm age	Number of years from the establishment of the company to the observation year
	Board	Number of directors	Natural logarithm of the number of directors
Moderating variable	Market	Marketization index	Obtained from the database of the marketisation index in each province of China

The study will make judgments based on the coefficients calculated. The sign of the coefficient corresponds to either a positive or negative correlation. The distinction between significance and non-significance is determined by the probability that the results are due to chance, represented by ***p, **p, and *p. For example, when $p < 0.05$, it indicates that the likelihood of obtaining an opposite conclusion in a repeated study under the same conditions is less than 5%. A p-value greater than 0.05 is considered "not significant," while $p \leq 0.05$ is considered "significant," and $p \leq 0.01$ is considered "highly significant." Additionally, after performing the regression analysis, the study uses the 'estat vif' test to ensure that there is no multicollinearity between the variables.

EMPIRICAL CONCLUSIONS AND ANALYSIS

Regression results on the relationship between digital transformation and company innovation

The baseline model's estimates are presented in table 4. The results indicate that the coefficient representing the impact of digital transformation on R&D intensity in textile and apparel companies is positive and statistically significant at the 5% level, thereby supporting Hypothesis 1. This hypothesis posits that an elevated degree of digital transformation in textile and apparel companies is associated with an increase in R&D intensity. A company's market position is influenced by various factors, including its revenue-based market share, company age, and size. Among the control variables, the coefficients for firm age and company size are both negative, aligning with the regression coefficient directions found in the study by Yue and Zhang [18], though with minor variations in significance levels. This negative association suggests that as companies mature, they might become complacent, diminishing their motivation for innovation and reform. In contrast, younger companies, often smaller and more dynamic, tend to exhibit a stronger drive for innovation [19]. Consequently, older and larger firms may inhibit innovative behaviours.

Concurrently, companies with a robust market position often display substantial revenue and sustained profitability. In such scenarios, the coefficient for ROA shows a significantly positive relationship with R&D

Table 4

IMPACT OF DIGITAL TRANSFORMATION ON COMPANY INNOVATION IN TEXTILE AND APPAREL COMPANIES	
Variables	**Rd**
Digi	0.0006**
	(2.2859)
Size	–0.0036***
	(–8.9230)
ROA	0.0370***
	(7.5697)
REC	0.0078
	(1.3339)
Top1	–0.0121***
	(–5.1914)
FirmAge	–0.0018
	(–1.5936)
Board	0.0104***
	(5.4684)
Constant	0.0707***
	(7.5734)
Observations	655
R-squared	0.2739
Indusry	Yes
Year	Yes

Note: t-statistics in parentheses; ***p<0.01, **p<0.05, *p<0.1.

intensity. Firms with healthy profit margins and stable profitability are more inclined to augment investments in innovation and R&D. The returns from such investments potentially enhance company revenue, thus creating a positive feedback loop. Additionally, there is a negative correlation observed between the ownership proportion of the largest shareholder and the number of directors. This suggests that in textile and apparel companies, a broad management team involved in decision-making is associated with greater investment in innovation and R&D. This finding aligns with the outcomes of a large-scale study encompassing various industries, underscoring a complex relationship between the market position of textile and apparel companies and digital transformation.

Moderating effect of marketisation level on the relationship between digital transformation in textile and apparel companies and innovation

Model 2 of this study investigates the moderating effect of the marketisation level on the relationship between digital transformation and R&D intensity in textile and apparel companies. The regression results, as shown in table 5, reveal that the coefficient for the interaction term is positive, albeit with a relatively low level of significance. This suggests that the impact of digital transformation on R&D intensity is enhanced as the marketisation level increases. This observation lends support to Hypothesis 2.

Heterogeneity analysis for further research

To enhance the precision of this study and deepen our understanding of the current developments within the textile and apparel industry, two additional factors were integrated into the research model: the geographic location of the company and its classification as a high-tech entity. The aim is to assess the differential impacts of digital transformation on innovation across these distinct structural dimensions.

The location of the company significantly influences its digital transformation trajectory. Companies in Eastern regions typically benefit from richer human and financial resources, more rapid technological advancements, and more profound reforms in traditional industries compared to their counterparts in non-Eastern parts of the country. Accordingly, this study categorises the sample into two groups: textile and apparel companies located in the Eastern region versus those in the non-Eastern region. A heterogeneity test is conducted within the empirical analysis to scrutinise these distinctions. In China, HNTEs exhibit a higher degree of digitisation compared to non-HNTEs. The sample is thus bifurcated into HNTEs and non-HNTEs, and a heterogeneity test is applied, with findings detailed in table 6.

The results indicate that the impact of digital transformation on innovation inputs is positively and significantly correlated at the 1% level for companies in Eastern regions. In contrast, for companies in non-Eastern regions, this impact is negative but not statistically significant. This discrepancy could be attributed to several factors: Firstly, textile and apparel companies in non-Eastern regions generally exhibit a lower quality of digital transformation and significant homogeneity, which undermines their competitive edge and diminishes their incentive to innovate. Secondly, companies in these regions are predominantly manufacturing-focused, with a dearth of original and innovative clothing brands, resulting in lower investments in innovation and R&D. Thirdly, there is a disparity in the focus on supportive policies for digital technology between the governments of Eastern and non-Eastern regions, with the former being more progressive and adept at implementing policies that promote corporate innovation and development. Both HNTEs and non-HNTEs show a positive coefficient regarding the impact of digital transformation on innovation intensity. This impact is statistically significant for HNTEs, suggesting that HNTEs have generally made notable strides in business model innovation through digital transformation and comprehensive informatisation management. In contrast, non-HNTEs face a significant degree of homogeneity in their digital transformation efforts, which have not yet been profoundly integrated into the core of their innovation processes.

Table 5

THE MODERATING ROLE OF THE DEGREE OF MARKETISATION

Variables	Rd
Digi	–0.0028
	(–1.3870)
Market	–0.0006
	(–1.4873)
x	0.0003*
	(1.6702)
Size	–0.0035***
	(–8.6130)
ROA	0.0379***
	(7.6314)
REC	0.0081
	(1.3684)
Top1	–0.0119***
	(–5.0998)
FirmAge	–0.0016
	(–1.4002)
Board	0.0102***
	(5.3157)
Constant	0.0744***
	(7.6608)
Observations	655
R-squared	0.2775
Industry	Yes
Year	Yes

Table 6

RESULTS FOR REGIONAL DIFFERENCES IN COMPANY LOCATION AND HI-TECH COMPANY CERTIFICATION

Variables	Eastern region	Non-eastern region	HNTE	Non-HNTE
dig	0.0009***	–0.0008	0.0008**	0.0002
	(3.2120)	(–1.1614)	(2.5131)	(0.5125)
Size	–0.0039***	0.0001	–0.0022***	–0.0039***
	(–8.9314)	(0.0776)	(–3.4158)	(–7.3681)
ROA	0.0348***	0.0622***	0.0350***	0.0345***
	(6.6258)	(3.3751)	(5.3045)	(5.0151)
REC	0.0028	0.0552**	0.0349***	–0.0060
	(0.4519)	(2.3455)	(4.0859)	(–0.7493)
Top1	–0.0138***	–0.0126	–0.0058	–0.0107***
	(–5.6335)	(–1.1877)	(–1.3328)	(–3.7152)
FirmAge	–0.0022*	–0.0037	0.0011	–0.0057***
	(–1.7369)	(–0.9718)	(0.6764)	(–3.5213)
Board	0.0129***	–0.0088	0.0194***	0.0015
	(6.2357)	(–1.2947)	(7.9220)	(0.5384)
Constant	0.0735***	0.0350	0.0085	0.1083***
	(7.2335)	(1.1452)	(0.6309)	(8.4087)
Observations	575	80	280	375
R-squared	0.2963	0.4981	0.3930	0.2526

CONCLUSION AND DISCUSSION

This study explores the impact of digital transformation on innovation within textile and apparel companies, using data from 2010 to 2022 from firms listed on the Chinese A-share for empirical analysis. It further investigates the moderating role of marketisation in the relationship between digital transformation and company innovation. Key findings are as follows:

- Digital transformation has a positive impact on company innovation.
- Marketisation positively moderates the relationship between digital transformation and company innovation.
- Regression results for companies in eastern regions align with the empirical analysis, whereas those for non-eastern companies display contrary results in the main regression coefficients, although these are not statistically significant.
- Both HNTEs and non-HNTEs demonstrate a positive impact of digital transformation on innovation intensity, with the effect being significant for HNTEs but not for non-HNTEs.

These conclusions extend existing research on digital transformation in textile and apparel companies and the factors influencing company innovation. This study selects one indicator from each of four dimensions – digital supply chain, performance evaluation, data-driven approaches, and information system development – to comprehensively assess the degree of digital transformation in textile and apparel companies. This methodology addresses the limitations of previous literature that often relied on subjective and relatively narrow measurement techniques. Furthermore, the study clarifies the mechanism by which digital transformation in traditional companies influences innovation. Drawing on theories of marketisation, the research confirms a moderating effect within this dynamic. By differentiating between Chinese textile and apparel companies based on location and high-tech status, the study fills gaps in existing research.

The methodology employed can be summarised as the development of a digital transformation degree model, the construction of an empirical model, and the application of regression analysis. This approach provides a framework for companies to assess the effectiveness of their digital transformation initiatives. Additionally, the indicators or parameters can be tailored as needed to adapt the model for studies in other industries or regions.

China's textile and garment industry is currently at a critical stage of innovation-driven development. The transformation, upgrading of the industry, and the healthy, long-term development of the economy necessitate a continuous improvement in the innovation capacity of enterprises. As digital transformation represents the future trend of development, enhancing technological innovation capabilities is increasingly crucial for traditional textile and garment enterprises. Based on the findings of this study, the following specific recommendations are proposed: 1) Textile and apparel companies that have grown to a certain scale may experience a lack of innovation and flexibility in transformation. To address this, such companies could establish subsidiaries to externalize innovation units and focus on digital transformation

efforts; 2) Conversely, small-scale textile and apparel companies may need to invest substantial funds in the early and middle stages of digital transformation, potentially leading to reduced investment in R&D. These companies should seek more external financing and strategically allocate funds according to the different sources of financing; 3) Since geographic location significantly affects the digital transformation and innovation outcomes of textile and apparel companies, those with the necessary resources should consider relocating to regions with favourable government policies that attract investment, to capitalize on better development opportunities; 4) Becoming a high-tech enterprise is an effective path for textile and apparel companies seeking progress and development. Companies should continuously enhance their operations by aligning with the requirements of high-tech enterprises; 5) The business environment in which a company operates also influences its digital transformation. Local governments at all levels should enhance their support for industry-wide digital transformation by adopting targeted, multi-tiered support strategies and incentives. These measures should encourage social capital to participate in the integration of digital transformation and innovation within traditional enterprises.

However, this study faces certain unavoidable limitations. Firstly, the research is confined to companies listed on the Chinese A-share market, suggesting that future studies should extend the analysis to other entities across various regions. Secondly, the research uses marketisation as a moderating variable; however, there is a continuing need to investigate the effects of other factors on the digital transformation in the textile and apparel industry.

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