Pakistan Journal of Life and Social Sciences

RESEARCH ARTICLE

Under E-Commerce and Intelligent Manufacturing: The Development Direction of Apparel Enterprises

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ARTICLE INFO	ABSTRACT
	This research aimed to explore the impact of the application of E-commerce and intelligent manufacturing technology in apparel enterprises on the development direction of enterprises, as well as the mediating role of technological ability improvement and consumer satisfaction. By constructing a strategic technology management framework, this study not only analyzes the direct impact of E-commerce and intelligent manufacturing on enterprise development performance, but also explores how technological capability improvement and consumer satisfaction play a mediating role in this process. The study used a quantitative approach, collecting data through questionnaires and testing hypothetical models using statistical analysis techniques such as regression analysis. The sample covers apparel businesses of different sizes to ensure broad applicability and representativeness of the results. The study found that the effective application of E-commerce and intelligent manufacturing, such as the integration of online sales systems, intelligent production lines, and data collection and analysis technologies, has a significant positive effect on improving enterprises' market expansion strategies, product innovation, and business model adjustments. At the same time, the improvement of technical capabilities and consumer satisfaction, as intermediary variables, play a key role in bridging the gap between enterprise technology application and development results. In other words, when a company performs well in technology management and application, consumer satisfaction improves, and the development direction of the enterprise will be clearer and more positive, which is reflected in higher market competitiveness and operational efficiency. Based on these findings, firstly, enterprises should further strengthen the application of E-commerce and intelligent manufacturing technologies to improve technical capabilities and consumer satisfaction. Secondly, enterprises should pay attention to the intermediary role of technical capability improvement and consumer satisfaction in promoting development, and improve the overall development performance of enterprises by optimizing these two aspects. Finally, the strategic framework proposed in this study provides a systematic and comprehensive perspective for apparel enterprises, which can help them gain a stronger competitive advantage in the era of digital transformation and intelligent manufacturing.

INTRODUCTION

In recent years, the rapid development of digital technologies such as E-commerce and smart manufacturing has significantly transformed industries around the world, and China's apparel industry is no exception. This study aims to explore the impact of E-commerce and intelligent manufacturing on the development direction of Chinese apparel enterprises, focusing on how these technologies can enhance their business strategies and operational efficiency.

E-commerce has revolutionized the way apparel companies interact with the market, providing a new platform for consumer interaction, marketing and sales. Liu Qiang (2022) pointed out in his research "The Impact of E-commerce on China's Apparel Market" that the rapid development of E-commerce platforms has provided new market opportunities for apparel companies, changed the traditional sales model, and improved market positioning and marketing effectiveness through data analysis. At the same time, smart manufacturing has become a key factor in reshaping the production process. According to Wang Yang's (2021) analysis in the article "The Improvement of Apparel Production Efficiency by Smart Manufacturing", apparel manufacturers can achieve higher accuracy, faster production time, and cost efficiency by integrating advanced technologies such as automation, artificial intelligence, and the Internet of Things (IoT).

However, the adoption of these technologies also presents challenges, including the need for significant capital investment, the complexity of managing new systems, and the need for ongoing staff training. Despite the enormous potential benefits, how these technologies affect the overall direction of the business has not been fully explored. (Premkumar & Roberts, 1999).

Therefore, this study attempts to fill this gap by examining how E-commerce and smart manufacturing affect the development of Chinese apparel enterprises, and examines the role of technological capability improvement and consumer satisfaction as mediating factors in this process. Through a mixed-methods study that combines quantitative and qualitative research, it provides comprehensive insights into the dynamic interactions between technological advancements and business performance in the apparel industry. The results of this study are expected to provide valuable insights for business leaders and policymakers to leverage new technologies to advance the apparel industry and better address the challenges and opportunities presented by the digital age.

LITERATURE REVIEW

E-commerce

E-commerce refers to commercial transactions carried out through electronic means, especially the Internet. This includes everything from the online presentation of products and services, to the transaction, to the final payment and delivery process. The core of E-commerce is the use of electronic technology to improve the efficiency and convenience of transactions, so that businesses and consumers can interact and transact efficiently in a virtual environment. (Lee & Kim, 2021; Xu & Jin, 2020).

Online sales: Measure the total sales of apparel companies on E-commerce platforms (e.g., Taobao, JD.com, Pinduoduo). Analyze the impact of E-commerce on your revenue through sales data and transaction records. (Ngai & Wat, 2006).

Customer Online Interaction: Evaluate customer interaction behavior on E-commerce platforms, including the frequency of reviews, ratings, and inquiries. This can measure the level of activity of online interactions by analyzing customer interaction data and feedback. (Lin & Wu, 2021; Xu & Jin, 2020).

Intelligent manufacturing

Intelligent manufacturing refers to the optimization of the manufacturing process through the integration of advanced information technology, automation technology, Internet of Things (IoT), artificial intelligence (AI) and big data analysis and other technologies. The core goal of smart manufacturing is to improve the efficiency, flexibility and quality of production while reducing production costs. (Oliveira & Martins, 2010; Yang & Lin, 2021).

Digitalization of the production line: Analyze the digitalization level of the production line, including the application of data collection, real-time monitoring and control systems. The increase in digitalization can be measured by the degree to which the digital systems and data of the production line are integrated. (Xu & Yang, 2020).

Implementation of real-time data collection and analysis: Evaluate whether companies are adopting real-time data collection and analysis technologies to optimize production processes. This includes the use of data sensors, the use of data analysis tools, and the implementation of data-driven decision-making.

Integration of intelligent technology in the production process: Measure the application degree of intelligent manufacturing technology (such as artificial intelligence, Internet of Things) in the production process. This includes the deployment of technology and the optimization effect of technology on the production process. (Oliver, 1980).

Technical Capability Enhancement

Technical capability improvement refers to the enhancement of an enterprise's operational and application capabilities in a new technological environment by investing in technology, training employees, and improving technical infrastructure. The improvement of technical capabilities includes not only the introduction and use of technology, but also the improvement of technical management and technological innovation capabilities. (Chau & Hu, 2001).

Frequency and effect of employee training on new technologies: Evaluate the frequency and effectiveness of employees receiving training on new technologies, including the number of training courses, the breadth of training content and employee satisfaction with the training. The effectiveness of training can be measured by the improvement of employees' technical mastery. (Parker & Martin, 2018).

Investment in technical support and maintenance: Analyze the investment of the enterprise in technical support and maintenance, including the configuration of technical personnel, the quality of technical support services and the response speed of technical failures. Inputs can be measured by the budget for technical support and the efficiency of technical problem solving. (Wu & Lin, 2022).

Implementation of technology upgrading: Evaluate the upgrading of enterprise technology infrastructure, including hardware and software updates, system upgrades and the introduction of new technologies. The implementation of technology upgrades can be measured by the frequency of updates and the effectiveness of technological improvements. (Park & Song, 2020).

Customer Satisfaction

Consumer satisfaction refers to the overall satisfaction of consumers with the products or services purchased. It reflects consumers' satisfaction with product quality, service quality, shopping experience, and after-sales service. A high level of consumer satisfaction often increases consumer loyalty and willingness to recommend brands. (Ajzen, 1991; Berger & Frey, 2020).).

Evaluation of product quality: Satisfaction is measured through consumers' evaluation of product quality. This includes the material, design, durability and degree of conformity of the product. Reviews can be obtained through consumer feedback and ratings. (Lin & Wang, 2022).

Overall purchase satisfaction: Measure consumers' overall purchase satisfaction by comprehensively considering product quality, shopping experience and customer service. Overall satisfaction can be assessed by a composite score in a questionnaire.

The development direction of China's garment enterprises

The development direction of China's garment enterprises refers to the changes and adjustments of enterprises in market strategy, product innovation, business model and competitive strategy. It reflects how companies develop and implement strategies to adapt to new market demands and technological challenges in a rapidly changing market environment. (Kim & Liu, 2022).

 Market expansion strategy: Evaluate the company's strategy in terms of market expansion, including measures to enter new markets, expand sales channels and increase market share. Measured by the planning and implementation of market expansion. (Li & Zhao, 2018).

Product innovation project: Analyze the investment and achievements of enterprises in product innovation, including the research and development of new products, the update of product design and the response to market demand. The effectiveness of product innovation can be assessed by the number of new products on the market and the market response. (Li & Wang, 2021).

Business model adjustment: Measure the adjustment of business model, including online transformation, business integration and service innovation. The adaptation of the business model can be assessed by the changes in the business model and the effectiveness of the implementation. (Porter & Heppelmann, 2014).

Changes in competitive strategy: Evaluate the adjustment of the company's competitive strategy, including pricing strategy, market positioning and brand building. Changes in competitive strategies can be measured by the implementation of the strategy and market response. (Ostroff, 2020).

Conceptual Framework

In this dissertation, a conceptual framework is used to systematically explain how E-commerce and smart manufacturing affect the development of Chinese apparel firms. The framework provides a comprehensive understanding of the two key factors of consumer satisfaction and technological capability improvement.
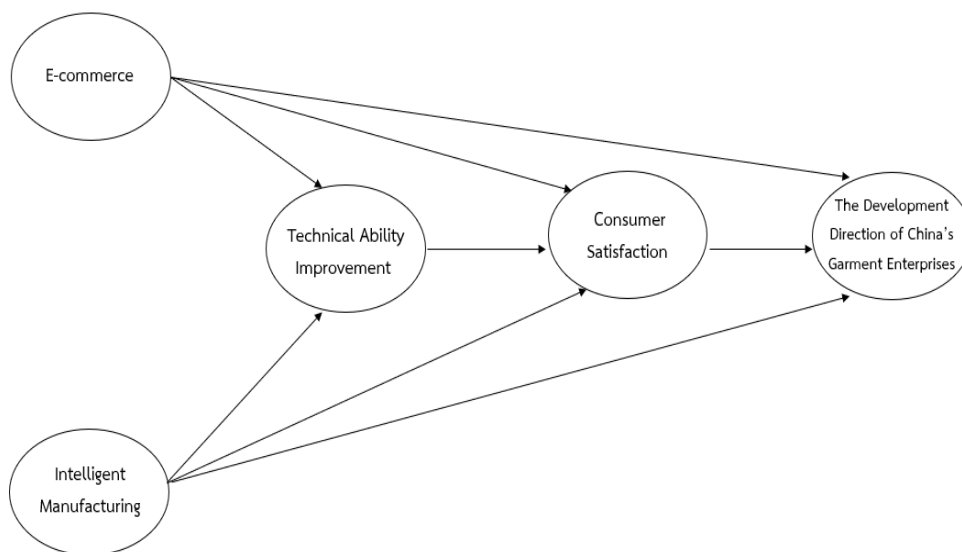

Figure 1 Theoretical Framework

H1: E-commerce has a positive impact on the development direction of China's garment enterprises.

H2: Intelligent manufacturing has a positive impact on the development direction of China's garment enterprises.

H3: E-commerce, technical ability improvement has positively mediation the relationship between E-commerce and the development direction of Chinese garment enterprises.

H4: E-commerce, consumer satisfaction has positively mediation the relationship between E-commerce and the development direction of Chinese garment enterprises.

H5: Technical ability improvement has positively mediation the relationship between intelligent manufacturing and the development direction of Chinese garment enterprises.

H6: Consumer satisfaction has positively mediation the relationship between intelligent manufacturing and the development direction of China's garment enterprises.

H7: E-commerce and intelligent manufacturing has positive impact on the market competitiveness of China's garment enterprises.

METHODOLOGY

This study adopts Mixed Methods Research, which combines quantitative and qualitative research, to comprehensively understand the impact of E-commerce and intelligent manufacturing on the development of Chinese apparel enterprises.

In terms of quantitative: First, through literature review, relevant academic articles, industry reports and policy documents are collected and analyzed to establish a theoretical basis for research. Secondly, a structured questionnaire was designed to survey the management and technical staff of Chinese apparel companies, and to collect data on E-commerce applications, intelligent manufacturing technology, technical capabilities, consumer satisfaction, and enterprise development direction. The questionnaire will be conducted online or face-to-face to ensure the representativeness of the sample and the reliability of the data.

On the qualitative side, semi-structured in-depth interviews were conducted with executives, technical experts and industry consultants of Chinese apparel companies to gain an in-depth understanding of E-commerce and smart manufacturing applications and practical operational challenges. Interviews will be recorded and transcribed, and data analysis will be performed using thematic analysis. In addition, representative enterprise cases are selected, their practical applications and effects in E-commerce and intelligent manufacturing are analyzed, corporate reports, performance data and industry reviews are collected, and successful experiences and key factors are extracted through descriptive case analysis methods.

Data analysis will use statistical analysis tools to conduct descriptive statistics, regression analysis and mediating effect analysis on the questionnaire data, verify the impact of E-commerce and intelligent manufacturing on the development direction of enterprises, and test the mediating role of technical ability improvement and consumer satisfaction. Qualitative data will be coded and subjectatically analyzed through qualitative analysis, extracting key themes and patterns to understand the implications and challenges in real-world applications. Reliability and validity will be verified during the study, the accuracy of the study tools will be ensured through pre-surveys and expert reviews, and participant privacy will be protected during data collection and processing. Through these methods, the research aims to provide a comprehensive analysis of E-commerce and smart manufacturing for the development of Chinese apparel enterprises, and to support the strategic decision-making of enterprises.

RESULTS

1. Regression analysis between E-commerce and intelligent manufacturing and enterprise development direction Regression analysis was carried out with E-commerce and intelligent manufacturing as independent variables and enterprise development direction as dependent variables, and the results are shown in Table 1

Table 1: Regression analysis between E-commerce and intelligent manufacturing and enterprise development direction

	Unstandardized coefficients		Standardization coefficient	t	conspicuousness
	B	**standard error**	**Beta**		
(constant)	.499	.105		4.742	.001
E-commerce and Intelligent manufacturing	.781	.034	.763	23.073	.001

Dependent variable: Enterprise development direction

According to the coefficient table, the regression coefficient of E-commerce and intelligent manufacturing on the development direction of enterprises is 0.763, T=23.073, P=0.001<0.01, which shows that E-commerce and intelligent manufacturing have a significant positive impact on the development direction of enterprises.

Table 2: Model Summary Results

Model	R	R square	Adjusted R square	Error in the standard estimation
1	.763	.582	.581	.2741

Table 3: ANOVA Results

Model		Quadratic sum	Free degree	Mean square	F	Conspicuousness
1	regression	40.004	1	40.004	532.383	1
	residual	28.779	383	.075		
	amount to	68.782	384			

The coefficient of determination (R-squared) is 0.681, indicating that E-commerce and intelligent manufacturing can effectively explain 60.6% of the variation in the development direction of enterprises. After bringing the independent variables into the regression equation, the detection results are obtained: F-value = 532.2383, Sig value is 0.001<0.01, which is statistically significant, which emphasizes the importance of E-commerce and intelligent manufacturing to the development direction of enterprises.

2. Regression analysis between E-commerce and intelligent manufacturing and technical capability improvement and consumer satisfaction Regression analysis was carried out with E-commerce and intelligent manufacturing as independent variables and technical capability improvement and consumer satisfaction as dependent variables, and the results are shown in table 4.

Table 4: Regression analysis between E-commerce and intelligent manufacturing and technical capability improvement and consumer satisfaction

	Unstandardized coefficients		Standardization coefficient	T	sig
	B	**standard error**	**Beta**		
(constant)	-.156	.172		-.905	.366
Technical capability improvement and consumer satisfaction	0.998	.055	.678	18.050	.001

Dependent variable: Technical capability improvement and consumer satisfaction

According to the coefficient table, the regression coefficients of E-commerce and intelligent manufacturing on the improvement of technical ability and consumer satisfaction were 0.678, T=18.050, P=0.001<0.01, which shows that E-commerce and intelligent manufacturing has a significant positive impact on the improvement of technical ability and consumer satisfaction.

Table 5: Model Summary Results

Model	R	R square	Adjusted r square	Error in the standard estimation
1	.678	.460	.458	.4486

Table 6: ANOVA Results

	Model	Quadratic sum	Free degree	Mean square	F	Conspicuous ness
1	regression	65.557	1	65.557	325.788	.001
	residual	77.070	383	.201		
	amount to	142.627	384			

The coefficient of determination (R-squared) is 0.458, indicating that enterprise E-commerce and intelligent manufacturing can effectively explain the 45.8% variation of technological capability improvement and consumer satisfaction. After bringing the independent variables into the regression equation, the detection results are obtained: F-value = 325.788 and Sig value is 0.001<0.01, which means that E-commerce and intelligent manufacturing can explain the improvement of technical capabilities and consumer satisfaction, but their explanatory power is slightly lower than that of the development direction of enterprises.

3. Regression analysis between technical capability improvement and consumer satisfaction and enterprise development direction

The regression analysis was carried out with E-commerce and intelligent manufacturing, technical capability improvement and consumer satisfaction as the independent variables, and the enterprise development direction as the dependent variable, and the results are shown in Table 4.28:

Table 7: Regression analysis between technical capability improvement and consumer satisfaction and enterprise development direction

Model	Unstandardized coefficients		Standardization coefficient	t	conspicuous ness
	B	**Standard error**	**Beta**		
(constant)	.526	.101		5.201	.001

E-commerce and intelligent manufacturing	.608	.044	.593	13.742	.001
Technical capability improvement and consumer satisfaction	.173	.030	.250	5.787	.001

Dependent variable: Enterprise development direction

According to the coefficient table, the regression coefficients of E-commerce and intelligent manufacturing on the improvement of technical ability and consumer satisfaction were 0.608, T=13.742, P=0.001<0.01, which shows that E-commerce and intelligent manufacturing have a significant positive impact on the improvement of technical ability and consumer satisfaction.

The regression coefficient of technical ability improvement and consumer satisfaction on the development direction of enterprises was 0.173, T=5.787, P=0.001<0.01, which shows that the improvement of technical ability and consumer satisfaction have a significant positive impact on the development direction of enterprises.

Table 8: Model Summary Results

Model	R	R square	Adjusted R square	Error in the standard estimation
1	.784	.615	.613	.2632

Table 9: ANOVA Results

Model		Quadratic sum	Free degree	Mean square	F	Conspicuous ness
1	regression	42.323	2	21.162	305.515	.001
	residual	26.459	382	.069		
	amount to	68.782	384			

In the third regression analysis, the impact of E-commerce and intelligent manufacturing, technological capability improvement and consumer satisfaction on the development direction of enterprises is simultaneously. The results show that E-commerce and intelligent manufacturing (regression coefficient 0.608) and technical capability improvement and consumer satisfaction (regression coefficient 0.173) have a significant positive impact on the development direction of enterprises. This shows that in addition to E-commerce and intelligent manufacturing itself, the improvement of technical capabilities and consumer satisfaction are also important factors affecting the development direction of enterprises. The coefficient of determination (adjusted R-squared) of the model is 0.613, indicating that these two independent variables together explain 61.3% of the variation in the direction of enterprise development, which is slightly higher than the explanatory power when only E-commerce and intelligent manufacturing are considered.

CONCLUSION

The data analysis results show that there is a significant positive correlation between E-commerce and intelligent manufacturing and enterprise development direction, and the correlation coefficient is as high as 0.763 (p<=.001). This shows that with the strengthening of enterprises in E-commerce and intelligent manufacturing, the development direction of enterprises has also been significantly improved. Enterprises should pay attention to the key role of E-commerce and intelligent manufacturing in driving the realization of corporate strategies and long-term goals, and promote the overall growth and market competitiveness of enterprises by continuously optimizing the application of these technologies.

Through in-depth analysis of the data, we find that there is a significant positive correlation between E-commerce and intelligent manufacturing and the improvement of technical capabilities and consumer satisfaction, with a correlation coefficient of 0.678 (p<=.001). This means that as E-commerce and smart manufacturing practices improve, so will technological capabilities and consumer satisfaction. Therefore, enterprises should strive to improve the application level of E-commerce and intelligent manufacturing to enhance consumer satisfaction with products and services, so as to enhance the market competitiveness and customer loyalty of enterprises.

The results show that there is a significant positive correlation between the improvement of technical ability and consumer satisfaction and the development direction of enterprises, and the correlation coefficient is 0.652 (p<=.001). This finding shows that as technological capabilities improve and consumer satisfaction increases, the direction of business development is also clearer and more successful. Therefore, enterprises should focus on technology investment and consumer demand satisfaction, and promote their strategic goals and long-term development through continuous technological innovation and optimization of consumer experience.

According to the regression analysis, the regression coefficient of E-commerce and intelligent manufacturing on the improvement of technical ability and consumer satisfaction was 0.678, and the T value was 18.050 (P=0.001<0.01 This result shows that E-commerce and intelligent manufacturing have a significant positive impact on the improvement of technical capabilities and consumer satisfaction. Enterprises should enhance consumer satisfaction and technical capabilities by strengthening the practice of E-commerce and smart manufacturing, such as improving the level of technology integration and optimizing the online consumer experience. This will not only improve market competitiveness, but also promote the sustainable growth and development of enterprises.

The data analysis results show that the impact of E-commerce and intelligent manufacturing on the development direction of enterprises is significant, with a regression coefficient of 0.678 and a T value of 18.050 (P=0.001<0.01）。This further confirms the importance of E-commerce and smart manufacturing in driving the direction of business development. Companies should continue to optimize these technology practices to adapt to market changes and consumer needs, thereby increasing their competitiveness and market share. This can not only promote the technological innovation of enterprises, but also the key factor to achieve long-term growth and success

According to the regression analysis results, the regression coefficient of technical ability improvement and consumer satisfaction on the development direction of enterprises is 0.173, and the T value is 5.787 (P=0.001<0.01). It can be seen that the improvement of technical capabilities and consumer satisfaction have a significant positive impact on the development direction of enterprises. Enterprises should promote the development of enterprises by improving their technical capabilities and enhancing consumer satisfaction, so as to enhance their market competitiveness and sustainable growth potential.

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