

# Path Analysis of the Impact of Digital Transformation on Export Performance of Textile and Apparel Companies

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## Abstract

The Fourteenth Five-Year Plan proposes to accelerate the digital upgrading of textile intelligence and fashion, and digital transformation has become the main theme of change in the textile and apparel industry. This paper analyzes the current status of digital transformation of textile and apparel enterprises in China from the perspective of textile and apparel enterprises, and focuses on the impact path of digital transformation of enterprises on their export performance: enterprise innovation path and export cost path. Textile and garment enterprises should focus on R&D innovation, realize personalized design services, open the whole production and operation data chain from digital production to digital terminal, and flexibly respond to the complex and changing export environment in order to promote the improvement of enterprise export performance.

## Keywords

Digital Transformation, Export Performance, Textile and Apparel Companies, Impact Path

## 1. Introduction

In recent years, Internet technology has developed at a high speed, and the popularity of the Internet and its globalization are bringing a new round of technological change to the world. Currently, China is in the rising stage from a large trading country to a strong trading country, and the wave of digital economy has had a profound impact on China's foreign trade market, and the digital technology revolution is reshaping the global trade landscape. Digital transformation has become an important part of the national strategy, and promoting the digital

transformation of enterprises is a strategic deployment of the country to meet the challenges of internationalization. At present, Chinese enterprises have made breakthroughs in digital transformation, and digital transformation has become the main theme of change not only in the “three new” economy, but also in the advanced manufacturing industry and traditional manufacturing industry. For the textile and apparel industry, a new generation of digital technology and the textile and apparel industry to deepen the integration, brings industry updates and value extension. The “14th Five-Year Plan” mentioned that we should accelerate the digital upgrade of textile intelligence and fashion, and put forward the visionary goal of becoming the world’s main driver of textile technology and an important leader in global fashion.

China’s textile and garment industry has been steadily improving its foreign trade and is changing from high-speed development to high-quality development, while facing the complex international situation of intensifying trade frictions and the traditional trade downturn in the post-epidemic era, how enterprises carry out digital transformation to cope with the complex and changing export environment has become an important issue that needs urgent attention. Based on this, this paper takes textile and garment enterprises in China as the research object, adopts text mining system to analyze the current situation of digital transformation of enterprises, systematically sorts out the theoretical mechanism of digital transformation of listed textile and garment enterprises affecting their exports, and studies the strength and path of influence, in order to provide suggestions for effective implementation of digital transformation of textile and garment enterprises in export trade, and provide suggestions for optimizing the digital transformation of textile and garment enterprises in China, in order to provide theoretical basis for optimizing the digital transformation of China’s textile and apparel enterprises, realizing the quality upgrade of China’s textile and apparel industry exports and solid foreign trade development.

## **2. Review of the Literature**

### **2.1. Digital Transformation**

Initially, most of the domestic and foreign scholars’ definitions of digital transformation were discussed around the perspective of industry or economic sectors, and with the depth of research extending the study of digital transformation to the enterprise level, for micro-economies such as enterprises. Meng & Zhao (2018) argue that digital transformation of manufacturing enterprises is the process of using big data for comprehensive and precise control of the whole manufacturing process and production process to achieve production optimization and resource optimization. Meng & Li (2018) believe that enterprises with successful digital transformation usually have three capabilities: collecting data at the endpoint and storing and analyzing it, digitizing the entire process of business operations, and having a platform for central control and connection of

the entire process of production management. Digital transformation of enterprises is a multi-dimensional, multi-value, multi-directional long-term evolutionary process (Wang & Wang, 2022), a major change in enterprise organization, management and cultural innovation, market and user demand-oriented digital transformation (Sun, 2021), digital industrialization and industrial digitization together constitute the digital transformation of enterprises (Wang & Chen, 2021), conducting Enterprises that conduct basic research on “digital” can better transform traditional enterprises and better promote industrial digitalization after forming certain industrialization.

## 2.2. Export Performance

Exporting is one of the main and basic ways of international business of enterprises, which refers to the process of selling products or services produced in the country to other countries, and in exporting activities enterprises do it either through direct exporting, or indirectly through agents and intermediaries. Performance is a comprehensive reflection of achievements and benefits (Zhao, 2010) and includes three dimensions: sales, profits and changes (Madsen, 1987). Enterprise performance is the most direct economic output of an enterprise, which refers to the business efficiency and operator performance during a certain operating period (Zhou & Li, 2001). The study of export performance by domestic and foreign scholars mainly includes the macro level of the country and the micro level of the firm, and there are more studies on the micro level. Diamantopoulos & Inglis (1988) argue that export performance is the result of the export behavior of a firm or organization under specific environmental conditions.

## 2.3. Impact of Digital Transformation on Export Performance

The impact of digitization on foreign trade has been studied by many scholars at home and abroad. Most of the early scholars have explored the impact of the Internet on the country's overall trade from a macro level, with digitalization playing a positive role in the area of trade in goods, trade in services, which can facilitate international trade by reducing transaction costs, increasing efficiency and alleviating information asymmetry, and also by reducing language distance to facilitate differentiated exports (Visser, 2019). With the continuous improvement of heterogeneous trade theory, scholars have gradually expanded the study of the relationship between digitization and export to the enterprise level, using enterprise microdata to argue that the research results show that the Internet and digitization significantly promote enterprise exports. Chaney (2011) by building a dynamic model of the composition of importers and exporters, the use of the Internet by enterprises improves the dynamics of export trade. The impact of digital transformation of enterprises on the technical complexity of exports has significant nonlinear characteristics (Lin & Li, 2021). While digital transformation has a direct positive impact on export performance, firm innova-

tion and market competition have a positive moderating role in it, while institutional environment has a negative moderating role (Yi & Wang, 2021). In addition, effective information disclosure has a positive contribution to corporate exports.

Based on the combing of related studies, this paper argues that enterprise digital transformation has a positive impact on exports, while there are few relevant studies for textile and apparel enterprises, so this paper takes textile and apparel enterprises in China as the research object, systematically sorts out the theoretical mechanisms through which digital transformation of textile and apparel enterprises affects enterprise exports, and studies through what paths textile and apparel enterprises affect enterprise exports in the context of digital transformation. To provide a theoretical basis for China's textile and apparel enterprises to apply digital transformation to cope with exports.

### **3. The Current Situation of Digital Transformation of Textile and Apparel Enterprises**

#### **3.1. Types of Digital Transformation of Textile and Apparel Enterprises**

Digital transformation of textile and garment enterprises is the process of maximizing the benefits of enterprises by using big data, cloud computing, artificial intelligence and other technologies to carry out strategic transformation, channel expansion and systematic digital upgrading of technology application in all aspects of design, manufacturing, marketing and service.

##### 1) Digital Design

With the continuous change of market popular elements and consumer tastes, product design becomes more important. In the digital design stage, through product data collection and analysis and 3D simulation technology, we collaborate with various platforms in the industry chain to realize personalization and visualization of product design. First, through HANA (database platform) to collect fashion trends, market consumption data, etc., the use of big data analysis means can timely predict the changes in demand of the product market. Secondly, the use of 3D visualization software, CAD system, 3D virtual technology and other rapid design and modeling of clothing to meet the personalization and diversification of clothing and shorten the clothing development cycle.

##### 2) Digital Manufacturing

In the digital manufacturing stage, in the business stages of product design, organization and production, digital technology is used to create digital workshops and factories, with intelligent factories as the core, from the consumer's purchase intention, to order submission, product design, supply chain procurement, manufacturing, logistics delivery, follow-up service and product quality tracking, until the end of product life, to create a whole life cycle process for intelligent coordination and management of Intelligent collaboration platform

of the industry chain. We apply intelligent systems such as EPR to collect and analyze information of resource elements in production and operation, MES/QMS/APS to schedule and optimize production and manufacturing plans, RFID and other intelligent technologies to collect and manage enterprise inventory data, and barcode technology to monitor the manufacturing process from textile fabric storage to finished garment production.

### 3) Digital Marketing

In the digital marketing stage, enterprises realize precise marketing through the online and offline integration of new media platforms and the digital experience of smart stores. Enterprises carry out advertising through a series of new media platforms such as portal information websites, social media platforms, video platforms, and self-media platforms, and push the corresponding products according to consumers' preferences to achieve precise marketing. By building terminal smart stores, enterprises can realize the perfect integration of online and offline clothing shopping through 5G technology, RFID technology and AR/VR technology, such as "store information collection, virtual scene fitting and mobile independent payment". Under the application of smart stores, the user data of multi-platform is captured and integrated by SCRM marketing system, which can effectively manage the circle and community of users and provide personalized marketing and services.

### 4) Digital Service

In the digital service stage, enterprises build a one-stop service platform for individual design, flexible production and accurate marketing through the cloud service platform. In the after-sales service stage, enterprises create appointment service and after-sales customer service windows on e-commerce platforms, brand websites or live broadcast platforms, etc. to open online digital service channels. For personalized service customization of apparel products, precise services are realized by establishing a membership system to analyze member tags, member behavior, etc. To ensure consumer experience, cooperation with logistics platforms ensures the continuity of digital services, forming a digital service system with an integrated e-commerce platform as the core.

## 3.2. Analysis of the Current Situation of Digital Transformation of Textile and Garment Enterprises

According to the "China Digital Economy Development Report" released by the China Academy of Information and Communication Research, in 2021, China's digital economy development made a new breakthrough, and the scale of digital economy reached 45.5 trillion yuan. Various industries are actively digitizing, and many leading textile and garment enterprises are actively exploring digital transformation, and some of them have achieved obvious results.

### 1) Keyword selection

In this paper, we choose to draw on the research method of Wu & Lin (2021): based on the text recognition function of python crawler, we use python to crawl

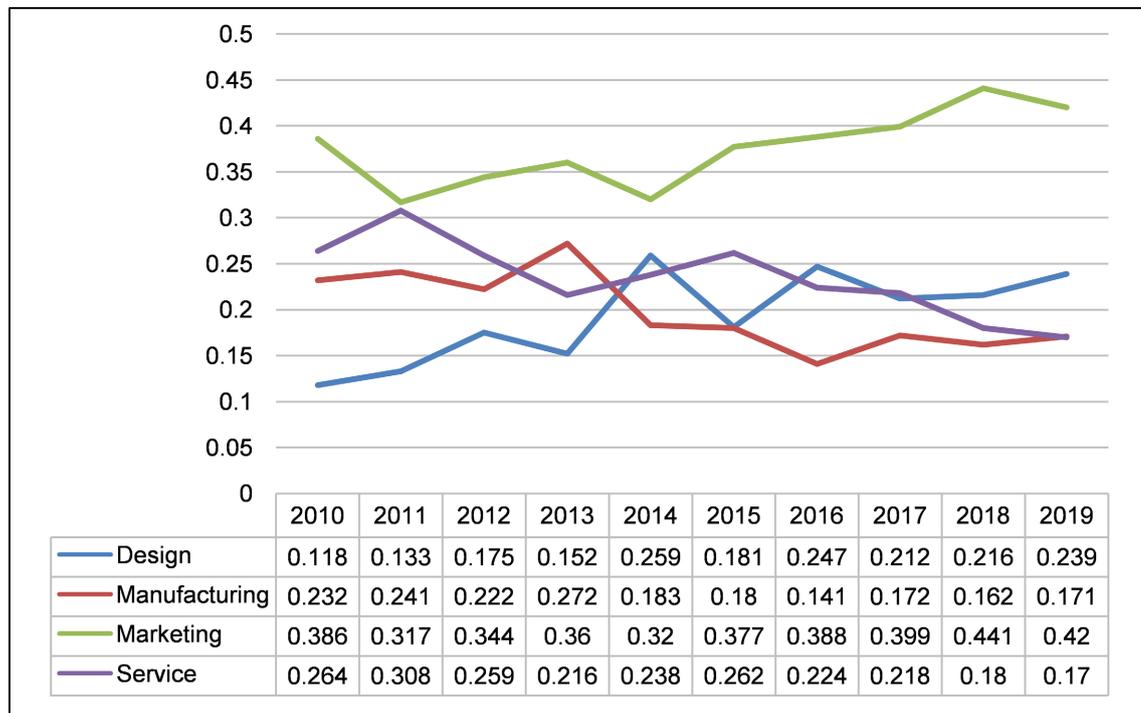
the keywords about digital transformation in the annual reports of A-share listed textile and garment enterprises, and get the frequency of the keywords of each index, and the higher the frequency of words indicates the higher the level of digital transformation of enterprises. We used several data analysis libraries in python, such as padans, pdfplumber and jieba, to crawl the annual reports of enterprises in Juchao.com, and excluded the samples that could not be identified due to formatting problems in the annual reports, and obtained a total of 30 sample enterprises. The text of digital transformation in the annual reports of textile and apparel companies was word-sorted by using JIEBA word-sorting software in GitHub open source project, and the phrases of digital transformation in the annual reports were identified by manual reading and Python algorithm. Secondly, we summarize the key words and phrases of digital transformation in the annual reports, expand the keyword lexicon, and classify them.

The measurement of digital transformation level of textile and apparel enterprises draws on the analysis of Luo Xuan (2021) for the digitalization of textile and apparel industry and the 2021 Accenture China Enterprise Digital Transformation Index Research Report (Accenture, 2021), mainly from the above four aspects. Digital design is mainly selected from four aspects: product data collection, product collaborative design, product process development, and product virtual simulation, for example: BMP platform, CAD system, etc.; digital manufacturing is mainly selected from four aspects: product planning and production, cost budgeting and procurement, product digital production, and product intelligent monitoring, for example: TOC rapid response supply chain, unmanned workshop, product upgrading, intelligent Factory, etc.; digital marketing is mainly selected from three aspects: digital analysis and operation, accurate management and sales, digital community management, e.g.: cloud shelf, cloud platform, smart store, live broadcast, etc.; digital service is mainly selected from after-sales service, personalized service customization, supply chain service module, e.g.: digital membership, smart logistics, etc.

2) Analysis of the current status of digital transformation of textile and apparel enterprises

The data are processed through the calculation process of entropy value method, and the weight values of 30 listed textile and apparel enterprises for each year from 2010 to 2019 are derived. The following are the weights accounted for by various types of indicators for each year, see **Figure 1**.

Taking the annual average of each indicator, the annual average weight of digital design is 19.32%, and the annual average weight of digital manufacturing is 19.76%, which are similar to each other. And the annual average weight of digital marketing is 37.52%, which is significantly higher than the other three indicators; and digital services accounted for 23.39%, second only to digital marketing, enterprises in the digital transformation pay more attention to digital marketing and services, the rapid development of the rise of live and 5G for the



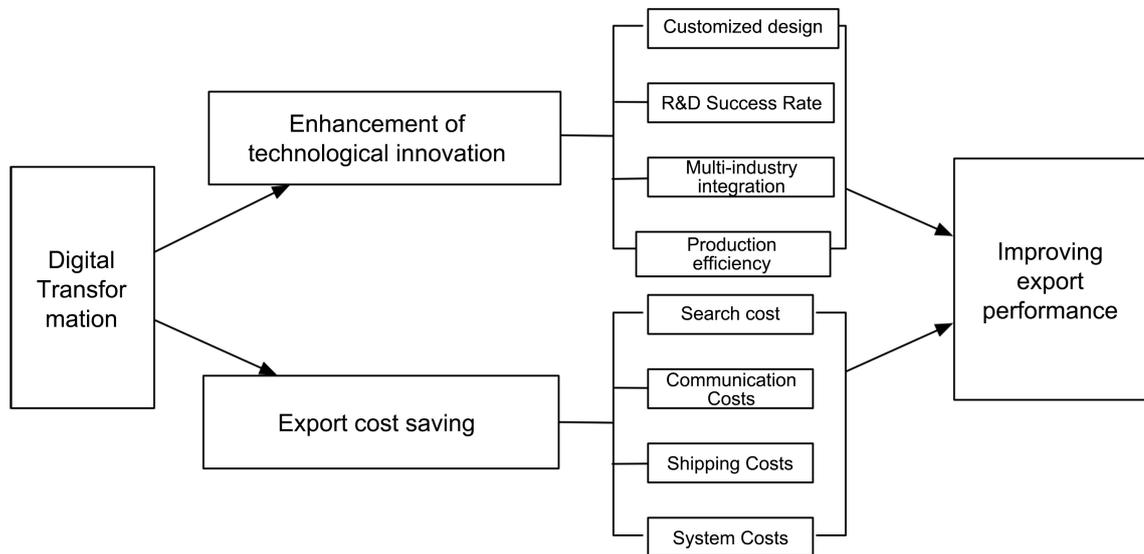
**Figure 1.** Digital transformation weighting level of textile and apparel brands 2010-2019 (Source: Calculated by annual report).

enterprise digital marketing to create the conditions, the gradual improvement of various types of app and platform for the enterprise digital. The rapid development of live streaming and 5G has created conditions for digital marketing, and the gradual improvement of various apps and platforms has provided channels for digital services.

From the time dimension, digital design accounted for 11.8% in 2010 to 23.9% in 2019, showing an increasing trend year by year, for the textile and apparel industry, “design” should be customer-centric, through product data collection and analysis, collaborate with the various platforms in the industry chain to achieve personalized product design services. Through the collection of fashion trends and other data from all parties, the use of big data analysis tools can be timely prediction of changes in product market demand, to truly achieve the consumer and market-oriented. We can see that in recent years, textile and apparel brands pay more attention to the personalized design of products.

#### 4. Influence Path of Export Performance of Textile and Apparel Enterprises under Digital Transformation

Digital transformation helps companies maximize their benefits while effectively improving their foreign export trade; in addition to having a direct impact on their export performance, it also has an indirect impact on their exports through technological innovation and cost reduction. The impact path is shown in **Figure 2**.



**Figure 2.** Impact path of digital transformation on export performance (Source: Compiled by the author).

#### 4.1. Innovation Effect Mechanism

##### 1) Customized design

Digital transformation can help companies to achieve interaction with consumers and customize their designs. Market trend elements and consumer tastes are constantly changing, and in order to meet consumer demand, textile and apparel companies are bound to achieve a flat and fast design process in apparel. Through the combined effect of manufacturing execution system (MES), enterprise resource planning (ERP), product lifecycle management (PLM) and other systems, using the big data analysis of consumers in the digital platform, consumer-oriented, accurate grasp of consumer preferences to meet diversified needs. In the apparel design process, we build the consumer's independent design interface on the digital platform to customize production and achieve technological innovation in the interaction between supply and demand. In the apparel production process, the use of consumer-centered flexible production to achieve an agile response to consumers' personalized needs, avoiding overproduction caused by traditional mass production, while enhancing the competitive advantage of textile and apparel enterprises and promoting sales, and thus exports.

##### 2) R&D success rate

The application of digital technology has expanded the use of resources and improved the utilization rate of resources and the success rate of research and development. In the research and development of apparel products, the Internet enables enterprises to reduce the difficulty of acquiring new technologies and knowledge and improve the innovation efficiency of production and design; through intelligent production and design systems such as cloud computing, big data and the Internet of Things, the quality of products and the success rate of research and development have been greatly improved. Through the Internet, enterprises can use R&D resources from all over the world to conduct open

R&D, thus realizing the long-term development of technological innovation in the textile and apparel industry.

### 3) Production efficiency

Digital transformation has brought new production tools to textile and garment enterprises and improved their productivity. Marx's basic principle mentions that the progress of productivity is first of all the progress of tools, and the progress of production tools, in turn, depends on science and technology. Digital tools can realize the intelligence of production, make the production process automatic, professional and fine operation, avoid errors in production, improve the quality of textile and garment products and increase the production efficiency of enterprises. Digital management in the production process can fully cope with the fast-paced industry competition of garment enterprises, save time and cost, and effectively improve production efficiency.

### 4) Multi-industry integration

The emergence of the Internet has pushed textile and garment enterprises to intelligent, digital transformation, enabling textile and garment enterprises to achieve online marketing, prompting further integration of the Internet and the textile and garment industry, giving rise to new industries such as online stores and live webcasts with goods, which have combined with each other to form a multi-industry integration and development model. Enterprises create consumer-centric online and offline integrated digital marketing channels by building their own data applications for front, middle and back office management and decision-making, and building smart stores to help enterprises realize data-based management. This model also motivates textile and apparel enterprises to diversify, opens up new ideas for technological innovation in the textile and apparel industry, and cultivates new momentum for the international development of textile and apparel enterprises.

## 4.2. Cost Effect Mechanism

While the Internet reduces fixed trade costs, it also reduces variable costs to a certain extent, thus increasing trade volume.

### 1) Search cost

Digital transformation can improve information transparency, avoid information asymmetry and reduce search costs. For both sides of the trade, in traditional international trade, it is more difficult for buyers and sellers to reach cooperation agreements due to excessive geographical distance. The application of digital platforms helps buyers and sellers conduct online transactions, saving the time and labor costs required at this step, and enterprises learn about the local business environment through the Internet, inquire about the business status of each other's enterprises, etc. With the development of digital platforms, cross-border e-commerce brings together different products from different enterprises on one platform, providing buyers with diverse choices. Buyers and sellers can quickly obtain quotes from each other, shortening the search time and improv-

ing the efficiency of transactions between buyers and sellers. The development of digitalization has led to more open and transparent information, making the export market tilted toward a perfectly competitive market, forcing exporters to improve product quality and productivity, and improving the export competitiveness of enterprises.

#### 2) Communication costs

Initially, when enterprises carry out export trade activities, they often transmit information by telegram and telephone; due to the emergence of the Internet, buyers and sellers can communicate and negotiate directly and timely through e-mail and online platforms, reducing the communication costs of both sides of the trade. Online platforms can intuitively display the characteristics of their respective products, simplify the link between apparel enterprises and consumers to dock and reduce communication costs. In the payment stage, the emergence of online payment also provides buyers and sellers with a more convenient payment method, which can significantly improve sales and transaction efficiency, thus promoting exports.

#### 3) Shipping costs

Logistics is crucial in export trade, online freight platform through the use of the Internet, big data, cloud computing and other digital information technology, the integration of transport traffic and cargo information and capacity information released by the owner, effective and reasonable resource allocation, speed up communication, improve the efficiency of order matching, it can be seen that the digital transformation of enterprises can affect the time and cost of transport between buyers and sellers. The Internet has enabled the gradual elimination of international trade barriers, enabling more cost-effective and efficient access to feedback information from upstream and downstream enterprises to meet customer needs. The application of the Internet of Things, cloud services and artificial intelligence has significantly improved the efficiency of the process flow of assembly and inspection.

#### 4) System costs

For the production stage, the government through the development of technical standards in health standards, by raising the production costs of foreign enterprises for trade protection, big data system gives domestic export enterprises transparent and comprehensive target market data, so that export enterprises in the development of production plans can reasonably and effectively avoid the possible trade protection measures encountered, thereby saving costs and improving export efficiency. For the transaction phase, the complexity of the tariff and commodity inspection process will increase the transaction costs in the system costs, the application of online service platform in the government sector, greatly improving the level of information technology of government departments, improve efficiency, thus speeding up the speed of import and export customs clearance, saving the cost of time and customs clearance costs of enterprises.

## 5. Concluding Remark

Under the background of digital economy, textile and garment enterprises in China should comply with digital development and accelerate the digital transformation of enterprises in order to cope with the complex and changing export environment. This paper discusses around textile and garment enterprises, analyzes the current situation of digital transformation of textile and garment enterprises through text analysis of enterprise annual reports, and elaborates the impact path of digital transformation on enterprise export performance, and concludes that textile and garment enterprises should improve their export performance by improving the level of enterprise innovation technology and reducing the cost of enterprise export when they carry out digital transformation, and solve the problem of digital transformation of enterprises from two perspectives.

On the one hand, at the production end, increase investment in R&D of digital technology, increase the proportion of scientific researchers, enhance the application and analysis of data through big data, AI, cloud computing and other technologies, improve production technology and increase production efficiency; use digital transformation to create flexible production lines, enhance their competitive advantages, expand the scale of business, improve the pricing ability of enterprises, and thus enhance export competitiveness. On the other hand, in the sales side, through the digital online platform and foreign customers timely communication and transactions, accurately grasp the needs of consumers, create personalized design services for customers, enrich pre-sales and after-sales services, enhance the core competitiveness of the brand, and fully promote the development of enterprise exports, from digital production to digital terminal to open the entire production and operation data chain, to achieve the integration of production and operation, and to improve the efficiency of business operation and export.

The limitation of this paper is that this paper is a study from the perspective of textile and apparel enterprises, which has limited contribution to the whole manufacturing industry. And although the digital transformation of enterprises is quantified, the main part mainly analyzes the impact path of digital transformation of textile and garment enterprises on export performance from a qualitative perspective, and the impact intensity cannot be analyzed intuitively, and a more detailed analysis of the relationship between digital transformation and export performance will be conducted later through quantitative analysis.

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## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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