

The Impact of Digital Transformation, Consumer Decision Mechanism, and New Product Design Planning on Sustainable Competitiveness in the Wooden Furniture Market

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Abstract

The objectives of this research were (1) to study the impact of digital transformation on consumer decision mechanisms, new product design planning, and sustainable competitiveness in the wooden furniture market; (2) to analyze how the consumer decision mechanism influenced new product design planning and sustainable competitiveness in the wooden furniture market; and (3) to examine the role of new product design planning in enhancing sustainable competitiveness in the wooden furniture market. The population comprised 930 employees and 90 administrators across 10 furniture enterprises, totaling 1,020 individuals. A total of 340 participants, including both furniture factory employees and management personnel, were selected for the study using a stratified random sampling technique. SEM analysis showed that digital transformation positively influenced the consumer decision mechanism (path coefficient = 0.82, $p < 0.001$), validating the hypothesis. Digital transformation also positively influenced wooden furniture's sustainable competition (path coefficient = 0.47, $p < 0.001$) and new product design planning (path coefficient = 0.63, $p = 0.032$). The consumer decision mechanism positively influenced new product design planning (path coefficient = 0.66, $p = 0.003$) and wooden furniture sustainable competition (path coefficient = 0.53, $p < 0.001$). Furthermore, new product design planning positively influenced wooden furniture sustainable competition (path coefficient = 0.78, $p < 0.001$). Therefore, based on the research results, non-standardized path coefficients were used in the study. Based on the p-values, it was determined that the 95% confidence intervals of all path coefficients did not

contain 0, and the results were statistically significant. This study clearly reveals how digital transformation drives the sustainable competitiveness of wooden furniture enterprises through key intermediary pathways.

Keywords: Digital Transformation; Consumer Decision Mechanism; New Product Design Planning; The Wooden Furniture Market.

Introduction

Digital transformation has played an important role in the strategic research process of the wooden furniture market. With the continuous development of information technology, wooden furniture enterprises have begun to realize the importance of digital transformation for improving production efficiency, optimizing supply chain management, expanding sales channels and providing personalized services. The research of consumer decision-making mechanism can help enterprises to better understand consumers' purchasing behavior and decision-making process, so as to carry out targeted marketing activities. With the constant change of consumer demand and the intensifying of market competition, wooden furniture enterprises need to constantly launch new products to maintain their competitive advantage. The research of new product design planning can help enterprises better understand market needs and trends, so as to design more innovative, differentiated and competitive products. In the process of new product design and planning, enterprises need to carry out market research, product positioning, design, development and testing to ensure the market success and commercial feasibility of the product. In general, the strategic research of digital transformation, consumer decision-making mechanism and new product design and planning on the wooden furniture market is a historical process of continuous development and improvement. With the progress of technology and the change of the market environment, wooden furniture enterprises need to constantly learn and innovate, to meet the needs of the market, and achieve commercial success (Zhu, 2025).

Based on the above theoretical integration, we propose a clear logical transmission chain of "DT → CDM → NPD → SC": 1. Digital transformation as the empowering foundation: Enterprises use technologies such as big data and artificial intelligence to profoundly change their interaction patterns with consumers, thereby reshaping consumer decision-making mechanisms. This enables companies to more accurately perceive the implicit demand and preferences of the market for sustainable products. 2. Consumer decision-making mechanism as an insight hub: Market insights reinforced by digital tools provide data-driven decision-making basis for new

product design planning. Enterprises are able to capture concrete innovation opportunities and transform abstract sustainable concepts into concrete design solutions that meet market demands.

3. New product design planning as a carrier of value realization: Ultimately, these design innovations that integrate sustainability and market orientation are restructured into the core resources of the enterprise through the product as a carrier, directly creating sustainable competitiveness that is difficult to imitate.

Although previous studies have explored the relationship between DT, CDM, and NPT, this study aims to fill the following research gaps:

Firstly, the fragmentation of mechanism research. Secondly, the singularity of theoretical perspective. Thirdly, the particularity of the industry context.

Based on this, this study proposes the following specific research questions:

1. In the wooden furniture industry, does digital transformation indirectly affect the sustainable competitiveness of enterprises through the chain intermediary effect of "consumer decision-making mechanism" and "new product design planning"?

2. In this impact path, does the new product design plan have a more direct driving effect on sustainable competitiveness compared to consumer decision-making mechanisms?

In conclusion, it is necessary to explore the components of the strategy of digital transformation, consumer decision mechanism, and new product design planning for the wooden furniture market and to develop managerial guidelines of the strategy of digital transformation, consumer decision mechanism, and new product design planning for the wooden furniture market.

Research Objectives

1. To study the impact of digital transformation on consumer decision mechanism, new product design planning, and sustainable competitiveness in the wooden furniture market.

2. To analyze how consumer decision mechanism influences new product design planning and sustainable competitiveness in the wooden furniture market.

3. To examine the role of new product design planning in enhancing sustainable competitiveness in the wooden furniture market.

4. To examine the mediating role of consumer decision-making mechanisms (CDM) and new product design planning (NPD) in the relationship between digital transformation (DT) and sustainable competitiveness (SC), structural equation modeling (SEM) was used for testing.

5. Introduce key corporate characteristics as control variables. This study incorporates enterprise size, age, and ownership type as control variables in the model to enhance the internal validity and reliability of the research findings.

Literature Review

Luo et al. (2024) pointed out that the focus of this research revolves around applying the dynamic capabilities (DC) considering technological, organizational, and environmental dimensions (TOE framework) to explore the digital transformation (DT) and innovation.

Quaye and Mensah (2019) illustrated that prior literature shows that digitalization can reduce transaction costs and improve operating efficiency.

Mardhiyah and Khairifa (2024). stated that digital Transformation (DT) has been considered a critical structural change for SMEs to be responsive and agile in today's dynamic and turbulent business environments. The strategic process of digital transformation (DT) enterprises utilizing digital technology to fundamentally change the value creation model.

In the same way, Husgafvel et al. (2018) pointed out that under the influence of the digital economy, the digital transformation of manufacturing enterprises has attracted widespread attention from scholars at home and abroad due to its uniqueness and importance.

Indeed, Susanty et al. (2020) concluded that enterprises have accelerated the pace of digital construction in the digital economy and post-epidemic era. Significantly, prior literature demonstrates the positive effects of digital transformation on firm performance and capital market performance.

Matarazzo et al. (2020) pointed that product design Verification and Validation (V&V) is an integral part of the new product development process to verify that the newly developed product meets its engineering specifications and fulfills its intended functions. New Product Design Planning (NPD) is a structured process that transforms market opportunities and technological possibilities into marketable products.

Barbaritano and Savelli (2021) pointed that the focus of this research revolves around applying the dynamic capabilities (DC) considering technological, organizational, and environmental dimensions (TOE framework) to explore the digital transformation (DT) and innovation. The current literature has shown a limited focus on integrating DC with the TOE framework, inspiring this research to address this gap.

Akbari et al. (2024) pointed that consumers perform decision-making (DM) processes to select their preferred brands during their entire consumer journeys. These DM processes are based on the multiple perceptions they have about the products available in the market they are aware of. Lee and Hsu (2025) pointed that honeycomb panels manufactured from wood and paper materials promote a high-value utilization of wood resources. Sustainable competitiveness (SC) refers to the long-term comprehensive advantages obtained by enterprises through managing economic, environmental, and social capital.

These specialized studies clearly demonstrate that the transmission chain of DT → CDM → NPD → SC not only exists in China's unique market and policy environment, but also exhibits distinct localization characteristics in each link, providing direct theoretical and practical basis for the construction of this research model.

Research Methodology

1. Type of Research

The researcher adapted quantitative research by using variable of the current situation of the strategy of digital transformation, consumer decision mechanism, and new product design planning for the wooden furniture market starting in the preparation of questionnaire as an instrument to collect data from samples in order to examine frameworks of the strategy of digital transformation, consumer decision mechanism, and new product design planning for the wooden furniture market.

2. Population and Sampling Method

The collection of data with questionnaires from population or samples were derived from quantitative research. The sample size was determined by the employees and administrators from 10 furniture enterprises in China, specializing in the effectiveness of the strategy of digital transformation, consumer decision mechanism, and new product design planning for the wooden furniture market. The population comprised 930 employees and 90 administrators across these 10 furniture enterprises, totaling 1020 individuals. By using a stratified random sampling technique, a total of 340 participants, including employees and management personnel of furniture factories, were selected for the study. Within this research framework, 7 enterprises from state-owned enterprises (SOE), 3 enterprises from individual enterprise. This study adopts. Five-point rating scale questionnaire: The instrument required the respondents to determine the degree to which each statement reflected the components of effectiveness. Each statement was to be measured on a 5–

point Likert scale (1932): 5 = Strongly Agree, 4 = Agree, 3 = Neutral, 2 = Disagree, and 1 = Strongly Disagree.

3. Hypothesis

Hypothesis 1: Digital transformation will influence consumer decision mechanism.

Hypothesis 2: Digital transformation will influence wooden furniture sustainable competition.

Hypothesis 3: Digital transformation will influence new product design planning.

Hypothesis 4: Consumer decision mechanism will influence new product design planning.

Hypothesis 5: Consumer decision mechanism will influence wooden furniture sustainable competition.

Hypothesis 6: New product design planning will influence wooden furniture sustainable competition.

Conceptual Framework

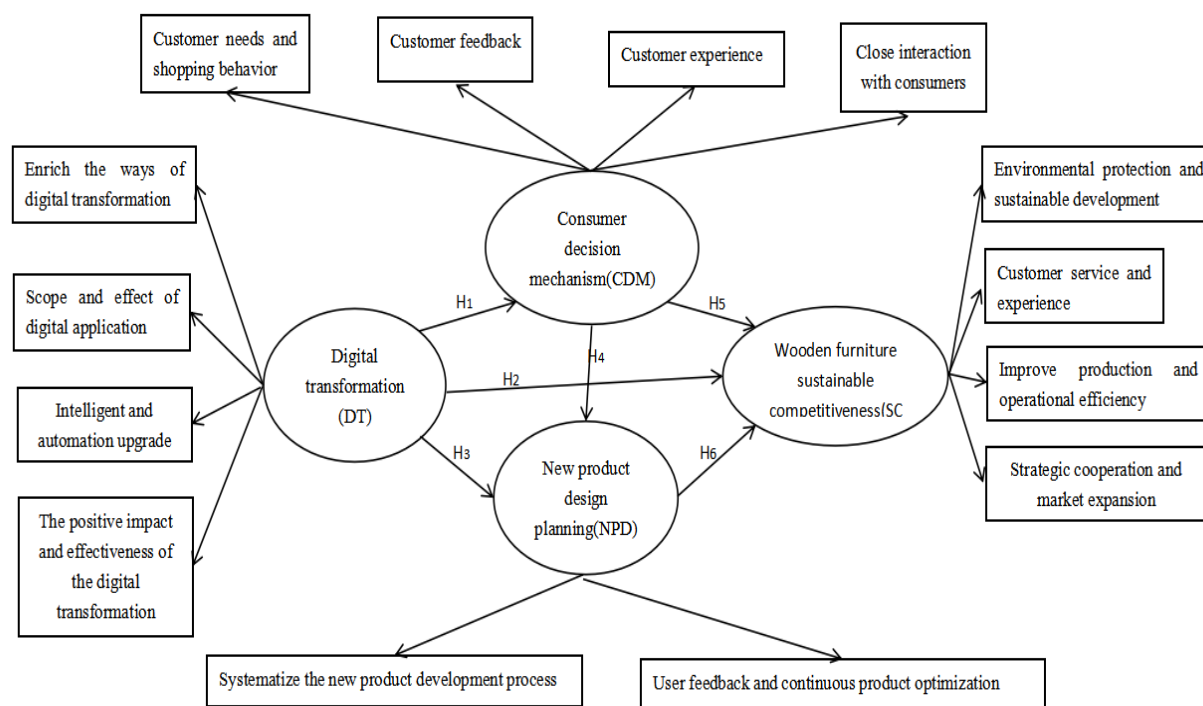


Figure 1 Conceptual Framework

(Source: Constructed by the researchers)

Using AMOS 28.0 to evaluate the hypothesized model. The SEM approach integrated both measurement and structural components to provide a holistic understanding of the linkages between digital transformation, consumer decision mechanisms, new product design planning, and sustainable competitiveness within the wooden furniture industry.

Research Results

In this study, an email containing a link to the questionnaire was sent to the employees and administrators from 10 of furniture enterprises in China through the online questionnaire star platform. In this way, a total of 340 questionnaires were distributed and 340 valid questionnaires were recovered, with a recovery rate of 100%.

1. Path analysis

Non-standardized path coefficient:

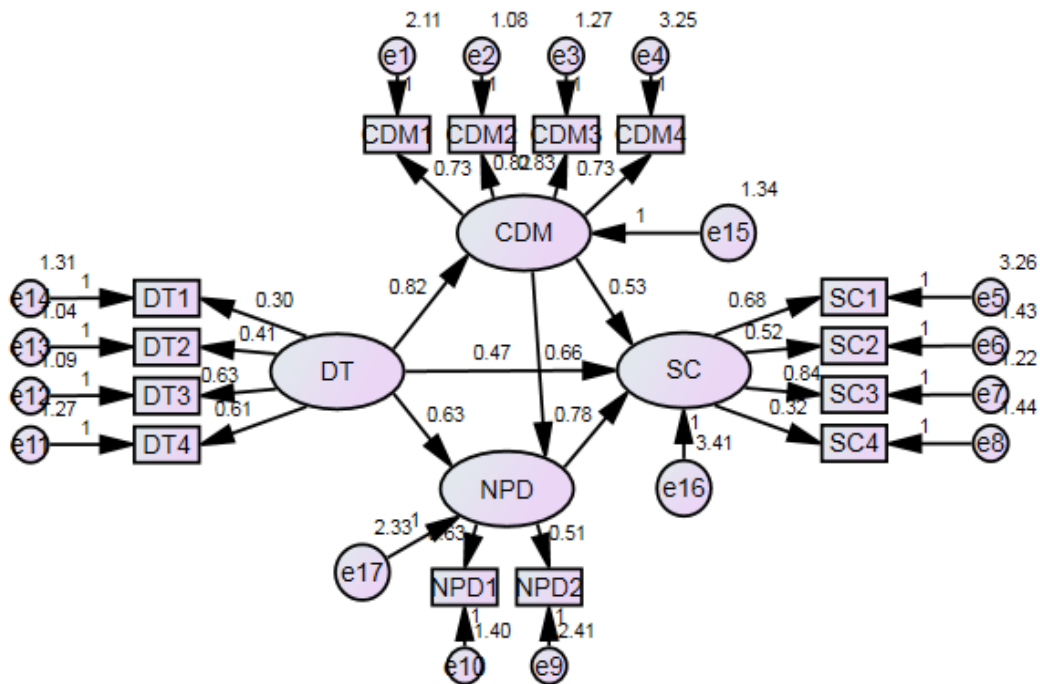


Figure 2 Results of Non-standardized path

(Source: Constructed by the researchers)

Model fit indices provided robust support for the theoretical framework:

The chi-square to degrees of freedom ratio (CMIN/DF) was 1.096, well below the conservative cutoff of 3.0, indicating excellent model fit.

The Root Mean Square Error of Approximation (RMSEA) value of 0.013 demonstrated exceptional fit, falling substantially below the conventional threshold of 0.08.

Both the Goodness of Fit Index (GFI = 0.914) and Adjusted Goodness of Fit Index (AGFI = 0.907) exceeded their respective benchmarks, further confirming strong model adequacy.

According to the results of structural equation model fitting, the CMIN/DF value is 1.096, which meets the adaptation standard < 3 to 5, the square root RMSEA value is 0.013, which is less than the critical value of 0.08, and the statistical tests GFI, AGFI, NFI, IFI, TLI and CFI all meet the adaptation standard. This indicates that the model has a good fit and the intrinsic quality is ideal.

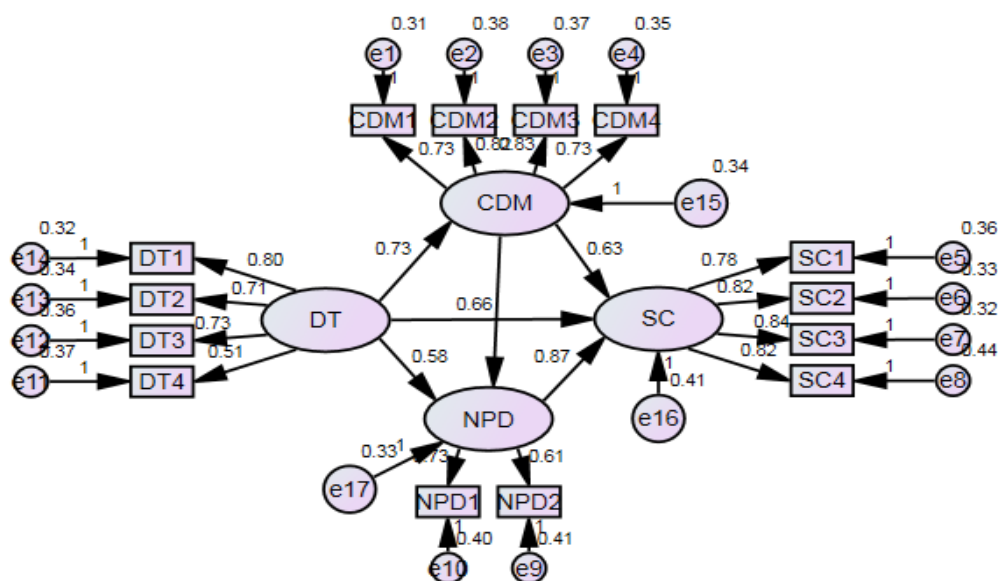


Figure 3 Results of standardized coefficient

(Source: Constructed by the researchers)

Standardized path coefficients indicated significant relationships across the model. Digital transformation demonstrated a strong direct effect on consumer decision mechanisms ($\beta = 0.762$, $p < 0.001$), suggesting that technological progress substantially shapes consumer purchasing behavior. A significant, though moderate, direct effect was also observed between digital transformation and sustainable competitiveness ($\beta = 0.389$, $p < 0.001$), indicating that digital initiatives contribute meaningfully to enhancing competitive advantage.

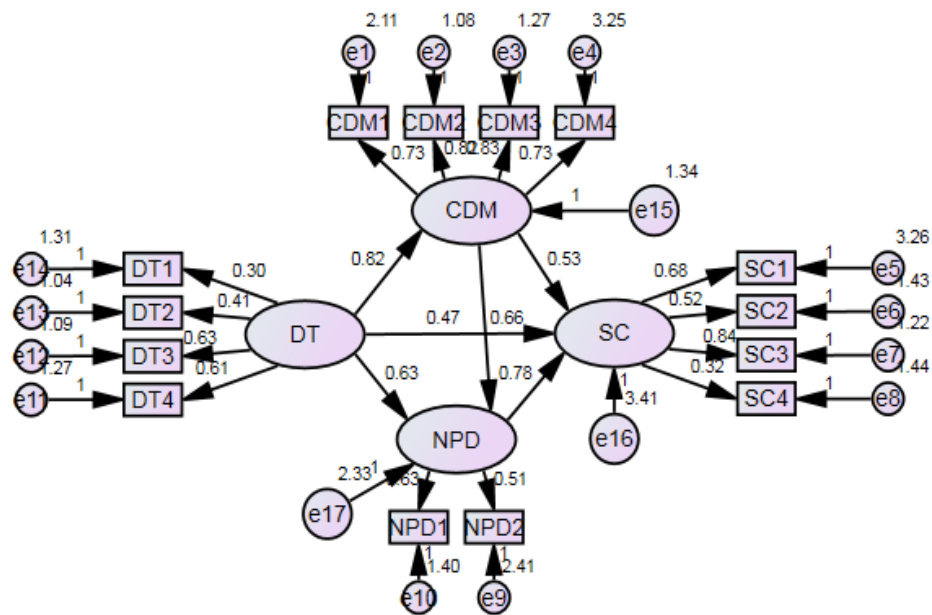


Figure 4 Results of Non-standardized path coefficient

(Source: Constructed by the researchers)

Consumer decision mechanisms exhibited significant influence on both new product design planning ($\beta = 0.146$, $p < 0.01$) and sustainable competitiveness ($\beta = 0.353$, $p < 0.001$), underscoring their function as a key mediating factor. New product design planning also demonstrated a significant positive effect on sustainable competitiveness ($\beta = 0.208$, $p < 0.001$), confirming its role in sustaining competitive advantage.

Incremental fit indices further validated the model's robustness. The Normed Fit Index (NFI = 0.918), Incremental Fit Index (IFI = 0.992), Tucker–Lewis Index (TLI = 0.992), and Comparative Fit Index (CFI = 0.992) all surpassed the recommended threshold of 0.90, collectively indicating excellent model fit. These results suggest that the theoretical model effectively represents the complex interrelationships among the variables studied.

Review of modification indices did not suggest any theoretically meaningful adjustments that would substantially enhance model fit, thereby supporting the originally proposed framework. The squared multiple correlations (R^2) for endogenous variables revealed that the model accounted for considerable variance in sustainable competitiveness ($R^2 = 0.543$), consumer decision mechanisms ($R^2 = 0.581$), and new product design planning ($R^2 = 0.468$).

Total effects analysis indicated that digital transformation influences sustainable competitiveness through both direct and indirect pathways, with the total effect ($\beta = 0.589$) exceeding the direct effect ($\beta = 0.389$). This suggests meaningful mediation via consumer decision mechanisms and new product design planning, highlighting that digital transformation's

impact on competitiveness is partially channeled through consumer behavior and product innovation processes.

Together, these SEM outcomes provide strong empirical validation for the theoretical model while offering detailed insight into the mechanisms by which digital transformation enhances sustainable competitiveness in the wooden furniture sector. The findings imply that effective digital transformation strategies must address both direct competitive outcomes and indirect effects mediated through consumer and product development pathways.

2. Path Analysis Results

Path analysis elucidated complex intervariable relationships, supported by strong model fit indices and statistically significant path coefficients. The model exhibited excellent alignment with empirical data across multiple fit indicators, as summarized in Table 1

Table 1 Structural equation model fit degree

Fit index	CMIN/DF	RMSEA	GFI	AGFI	NFI	IFI	TLI	CFI
Adaptation criteria	< 3–5	< 0.08	> 0.85	> 0.9	> 0.9	> 0.9	> 0.9	> 0.9
Test results	1.096	0.013	0.914	0.907	0.918	0.992	0.992	0.992
Fit Judgment	Matching	Matching	Normal	Matching	Matching	Matching	Matching	Matching

The model fit indices collectively demonstrated strong structural validity. The CMIN/DF value of 1.096 was well below the conservative threshold of 3.0, indicating excellent model fit. The Root Mean Square Error of Approximation (RMSEA) value of 0.013 reflected exceptional fit, falling substantially below the conventional threshold of 0.08. Additional fit indices further supported the model's validity: GFI (0.914), AGFI (0.907), NFI (0.918), IFI (0.992), TLI (0.992), and CFI (0.992) all exceeded the recommended threshold of 0.90, confirming robust model performance across multiple evaluation criteria.

Discussion

1. To study digital transformation affected consumer decision mechanism

Consumers can easily access product information, including different brands, prices, features, and user reviews. This convenient access to information makes the consumer decision-making process more rapid and efficient. Consumers tend to check social media recommendations and user reviews before buying, which may not only affect their perception of the brand, but may also potentially change their buying decisions. This is correspondence with the Kuys et al. (2021)'s

theory. E-commerce platforms use big data to analyze consumer behavior and provide them with personalized product recommendations. This customized shopping experience improves consumer satisfaction and purchase conversion rates. More and more brands provide personalized customized services, and consumers can design unique products according to their own needs to meet their personalized needs. Companies collect consumer feedback through online platforms, which can understand consumers' preferences and needs in real time, thus adjusting their product strategies. Consumer sense of engagement enhances their loyalty to products and brands. Through the crowdfunding platform, consumers can directly participate in the design and development process of products, enhancing the sense of investment in purchase. This is correspondence with the Husgafvel et al. (2018)'s theory. Digital transformation not only accelerates the process of consumer information acquisition but also reshapes decision-making pathways through algorithmic intervention and social validation. Specifically, digital platforms (such as e-commerce websites and social media) enable consumers to instantly access product information, user reviews, and price comparison data. Among these, over 71% of consumers query product details via smartphones, while 68% rely on social media evaluations. It significantly shortens the decision-making cycle and reduces uncertainty. Big data and AI algorithms generate personalized recommendations by analyzing user behavior, which not only enhances purchase conversion rates but also raises consumer concerns about privacy protection due to opaque data usage

Therefore, under the digital backdrop, the consumer decision-making mechanism exhibits a dual characteristic of "efficiency—fragility," where its rationality depends not only on information accessibility but also on the transparency and credibility of platform algorithms.

2. To study digital transformation affected wooden furniture sustainable competition.

Through digital technology, enterprises can realize the real-time monitoring and management of the supply chain, and improve the efficiency of raw material procurement and product distribution. This helps to reduce resource waste and reduce the environmental impact. This is correspondence with the Husgafvel et al. (2018)'s theory. Digital tools are able to track wood sources and ensure them come from sustainably managed forests, thereby enhancing consumer trust and recognition of the brand. Using computer-aided design (CAD), virtual reality (VR) and other technologies, we can better meet the personalized needs of consumers, while reducing material waste, and promote the concept of green design. The introduction of automation

and lean production technologies can improve production efficiency, reduce energy consumption and night production costs, and have a positive effect on achieving sustainable development goals. With big data analysis, companies can deeply understand consumer preferences and more effectively develop marketing strategies to improve sales conversion rates. Digital transformation enables companies to better communicate with consumers and share the sustainable practices and social responsibilities of the brand, which increases consumer loyalty to the brand. Digital tools can support the full life-cycle management of products from design to recycling, promote the recycling and remanufacturing of wooden furniture, and reduce waste generation. The digital transformation has strengthened the sustainable competitiveness of the wooden furniture industry through supply chain transparency, resource efficiency improvement, and environmental certification. The Internet of Things and blockchain technology have enabled wood traceability, ensuring that raw materials come from sustainably managed forests (such as FSC certification), which directly responds to the growing demand of consumers for environmentally friendly procurement. Computer aided design (CAD) and virtual reality (VR) technologies support green design concepts by reducing material waste during the design phase, while automated production systems reduce energy consumption and costs through lean management. Digital tools can support the full lifecycle management of products, from design to recycling, promoting the recycling and remanufacturing of wooden furniture, and reducing waste generation.

3. To study digital transformation affected new product design planning

Digital transformation encourages enterprises to collect and analyze large amounts of data, which can more accurately capture market trends and user needs, and help design teams better understand target customers, so as to develop new product designs that are more in line with market needs. This is correspondence with the Husgafvel et al. (2018)'s theory. By analyzing users' preferences and behaviors, enterprises can realize large-scale personalized customization and provide products more in line with users' needs. Digital tools (such as 3D printing) can accelerate the prototyping process, allowing the design team to quickly verify the design concept and iterate. This fast feedback loop helps to reduce the waste of time and resources. Digital transformation drives the evolution of new product design towards data-driven, collaborative, and agile approaches. Enterprises use big data analysis to capture market trends and user preferences in real time, making designs more closely aligned with actual needs; Cloud collaboration tools facilitate cross departmental team sharing of information and accelerate design iterations. Artificial intelligence technology further empowers generative design, automatically optimizing product

performance and predicting market reactions, reducing trial and error costs. Meanwhile, 3D printing and virtual prototyping technology have shortened the sample development cycle, enabling enterprises to quickly validate concepts and collect user feedback, forming a closed loop of "design test optimization".

4. To study consumer decision mechanism affected new product design planning

Through quantitative and qualitative market research, enterprises can understand consumers' needs, preferences and purchasing motivation. This information provides guidance for new product design and ensures that the product can meet the actual needs of the target market. Establishing consumer portraits can help enterprises identify the characteristics and behavior patterns of specific groups, so as to make targeted adjustments in the design stage and improve user experience. Consumers will evaluate the relationship between the value and the price of the product during the purchase process. This is correspondence with the Červený et al (2022)'s theory. New product design needs to highlight its unique selling points to enhance consumers' perception of value, such as function, quality, brand image, etc. Understanding the advantages and disadvantages of competitive products can help new product design to become more differentiated and improve market competitiveness. Consider in the design process how to surpass competitors in functionality, design and experience. Consumers' emotional experience has an important impact on the decision-making process. In the design process, we need to pay attention to visual aesthetics, brand stories and emotional resonance, so as to enhance the attractiveness of products to consumers. Consumers are often influenced by others (such as friends, family members, Internet celebrities, etc.). Product design and marketing strategies should take into account the role of social media and enhance product recognition through word-of-mouth communication and user participation. Understanding what scenarios consumers use the product can provide important information for design. For example, different use environments (home, office, outdoor) may require different product features and functions. The consumer decision-making mechanism directly guides the direction of new product design through demand feedback and value perception. Quantitative and qualitative market research helps companies build accurate user profiles, making design adjustments more targeted. Consumers' evaluation of product value and price in the decision-making process requires new product designs to highlight unique selling points in order to enhance perceived value.

5. To study consumer decision mechanism affected wooden furniture sustainable competition

With the popularization of the concept of sustainable development, more and more consumers pay attention to the environmental protection of products. Wooden furniture is often seen as a more environmentally friendly choice because of its renewable quality. Businesses need to highlight this in product design and marketing to attract this category of consumers. Consumer choice of wooden furniture may be influenced by ecological labels or certification, such as FSC (Forest Management Council) certification. These signs can increase consumers' trust in product sustainability. Wooden furniture is generally considered to have a high quality and durability. Consumers are often willing to pay a premium for durable and high-quality furniture, so the emphasis on the selection and craftsmanship of materials in the production process can effectively enhance consumers' sense of identity. Consumers will consider the expected service life and later maintenance cost of furniture when making decisions. Excellent durability and easy maintenance characteristics will encourage them to choose wooden furniture. Although wooden furniture may have many advantages, the price is still an important factor for many consumers to make decisions. This is correspondence with the Rame et al. (2023)'s theory. Enterprises need to maintain product quality while balancing production costs and market pricing, and improve the cost performance to attract more consumers. When consumers evaluate wooden furniture, they usually conduct cost performance analysis. In addition to the initial purchase price, it also includes the economic and environmental benefits in the use process. This is correspondence with the Wang & Sheng (2024)'s theory. Consumer attention to sustainability has become a key moderating variable for the competitiveness of wooden furniture. Environmental certification (such as FSC) enhances consumers' trust in sustainable brand practices through signal transmission mechanisms, while durability and maintainability improve cost-effectiveness perception by reducing long-term usage costs. However, price sensitivity remains a core constraint – some consumers may abandon sustainable options due to premiums, especially in markets lacking policy subsidies. Therefore, sustainable competition not only relies on environmental attributes, but also needs to highlight long-term economic benefits through digital marketing and resolve the contradiction between sustainability and affordability.

6. To study new product design planning affected wooden furniture sustainable competition

The design of wooden furniture should give priority to the use of wood from renewable and sustainable sources. For example, choosing certified wood (such as FSC certification) can not only reduce the impact on the environment, but also attract customers who focus on sustainable consumption. In addition to traditional wood, the development and use of other environmentally friendly materials (such as recycled wood, bamboo or composite materials) can also improve the sustainability of the products and meet the needs of different consumers. The modular design concept can improve the functionality of furniture while reducing material waste in the production process. This design method also facilitates consumers to combine according to the actual needs to extend the service life of the product. The new product design drives sustainable competition in wooden furniture through material innovation, structural optimization, and scene adaptation. Modular design reduces material waste and extends product lifespan, while the Life Cycle Assessment (LCA) method ensures resource efficiency at all stages from procurement to recycling. In addition, flexible design adapts to diverse home spaces and reduces substitutional obsolescence by enhancing functional adaptability. It should be emphasized that sustainable design needs to balance aesthetics and functionality, avoiding sacrificing user experience due to excessive pursuit of environmental protection, which may lead to a decrease in market acceptance.

New Knowledge from Research

The new product design drives the sustainable competitiveness of wooden furniture through material innovation, structural optimization, and scene adaptation. The material selection prioritizes renewable resources (such as bamboo or FSC certified wood) to reduce environmental footprint, and improves resource efficiency through modular design and lifecycle assessment. In terms of material innovation, fast renewable materials such as bamboo and wood have become environmentally friendly alternatives to traditional wood due to their short growth cycle and strong carbon sequestration ability. Its application not only reduces dependence on forest resources, but also lowers overall carbon emissions through low-carbon processing processes. Modular design reduces waste generation in the production process through detachable and reconfigurable structures, and facilitates maintenance and upgrades, thereby supporting the practice of circular economy models.

Conclusion

1. Correlation strength and direction between variables

Correlation analysis shows that digital transformation, new product design planning, and consumer decision-making mechanisms are all significantly positively correlated with the sustainable competitiveness of wooden furniture (all r values >0 , p values <0.01). This indicates that the enhancement of these factors may have a positive promoting effect on sustainable competitiveness. Based on the magnitude of the correlation coefficient r , it can be determined that the degree of closeness between each factor and sustainable competitiveness, from strong to weak, is as follows: digital transformation, new product design planning, and consumer decision-making mechanism. It should be noted that the value of r only represents the strength and direction of linear correlation, and the closer its value is to 1, the stronger the linear relationship.

2. Differential analysis of demographic characteristics

The analysis of variance results showed that the sustainable competitiveness of wooden furniture, as well as the three influencing factors of digital transformation, consumer decision-making mechanism, and new product design planning, did not show significant differences among different age groups, education levels, positions, monthly and annual household incomes. This result may indicate that concerns about the sustainability of wooden furniture, awareness and adoption of digital tools, and consumer decisions based on new product design are gradually becoming a universal trend that transcends traditional demographic boundaries in the current socio-cultural context. In other words, the concepts represented by these variables may have broad universality in their influence, rather than being specific to a particular social subgroup. Future research can explore whether other potential moderating variables, such as environmental values, digital literacy, etc., will have differential effects.

3. Impact path and model fitting goodness

Path analysis shows that the structural equation model has good fitting indicators ($CMIN/DF=1.096<3-5$, $RMSEA=0.013<0.08$, GFI, AGFI, NFI, IFI, TLI, CFI all meet the standards), indicating that the theoretical model matches the actual data well and has high intrinsic quality, which can effectively explain the relationships between variables.

All research hypotheses have been validated:

Digital transformation has a significant positive impact on consumer decision-making mechanisms (path coefficient $=0.82$, $P<0.001$).

The digital transformation has a significant positive impact on the sustainable competition of wooden furniture (path coefficient=0.47, $P<0.001$).

Digital transformation has a significant positive impact on new product design planning (path coefficient=0.63, $P=0.032$).

The consumer decision-making mechanism has a significant positive impact on new product design planning (path coefficient=0.66, $P=0.003$).

The consumer decision-making mechanism has a significant positive impact on the sustainable competition of wooden furniture (path coefficient=0.53, $P<0.001$).

The new product design plan has a significant positive impact on the sustainable competition of wooden furniture (path coefficient=0.78, $P<0.001$).

4. Theoretical contributions and management insights

The main theoretical contribution of this study is to construct and validate an integrated theoretical framework, revealing how digital transformation can enhance the sustainable competitiveness of wooden furniture enterprises by stimulating positive consumer decision-making mechanisms and driving effective new product design planning. The path coefficient indicates that new product design planning is the most direct and strong driving factor for enhancing sustainable competitiveness, while digital transformation plays a fundamental empowering role.

In management practice, wooden furniture enterprises should prioritize promoting digital transformation as a strategic cornerstone for enhancing sustainable competitiveness. Enterprises can utilize digital technology to optimize supply chain transparency, promote the use of environmentally friendly materials, and use data analysis to more accurately respond to market demand. At the same time, enterprises should attach great importance to new product design planning, integrate sustainability and modular design concepts into the entire product development lifecycle, thereby significantly improving resource utilization efficiency and product market attractiveness. In addition, it is crucial to actively guide and comply with consumers' preferences for sustainable decision-making, and enhance consumers' trust and recognition of brand sustainable practices through clear communication of environmental information.

5. Research limitations and future directions

This study has some limitations. Firstly, cross-sectional data is difficult to conclusively infer causal relationships between variables, and future research can use longitudinal studies or experimental methods to further verify them. Secondly, the research subjects may mainly focus on specific regions or types of enterprises, and the sample size can be expanded in the future to

enhance the universality of the conclusions. Finally, the model may not yet include all key variables, and future research can introduce moderating or mediating variables such as firm size, market competition intensity, macroeconomic policies, etc., to make the model more comprehensive.

In summary, this study confirms the significant promoting effects of digital transformation, consumer decision-making mechanisms, and new product design planning on the sustainable competitiveness of wooden furniture, providing a theoretical basis and practical path for the industry to achieve sustainable development in the context of digitalization.

Suggestions

1. Develop a phased digital transformation roadmap

Enterprises should avoid one-time large-scale investments and instead adopt a gradual and incremental strategy. In the initial stage, priority can be given to investing in supply chain visualization systems (such as blockchain traceability technology) to ensure that wood sources comply with sustainable certification standards such as FSC, which directly responds to consumers' trust in environmentally friendly materials. The mid-term focus is to use big data to analyze consumer behavior and preferences, providing real-time and accurate market insights for new product design, thereby enhancing the product's market adaptability. The long-term goal is to build a digital management system that covers the entire product lifecycle, from design, production, use to recycling and reuse, to comprehensively improve resource utilization efficiency. This staged investment helps to control risks and validate the effectiveness of each step.

2. Deepen data-driven sustainable product design

Enterprises need to systematically collect and analyze data generated by consumers in the decision-making process (such as online reviews, social media feedback), and deeply integrate these insights into the New Product Design (NPD) process. Specifically, modular design and environmentally friendly materials (such as bamboo and recycled wood) should be prioritized to extend product lifespan and reduce environmental footprint. At the same time, design needs to strike a balance between sustainability, aesthetics, and functionality, avoiding sacrificing user experience and market acceptance due to excessive pursuit of environmental protection.

3. Strengthen the construction of supply chain collaboration and transparency

Strengthen collaboration with internal departments (design, production, marketing) and external suppliers through digital platforms to ensure transparent and controllable information

throughout the entire process from raw material procurement to product delivery. Implementing digital traceability (such as FSC certification) is not only a means to meet compliance requirements, but also an important way to convey brand sustainability commitments to consumers and build brand trust.

4. Establish industry level data standards and certification incentive systems

Relevant government departments or industry associations can take the lead in developing data exchange and sharing standards for the supply chain of wooden furniture, promoting the interconnection of traceability information within the industry. At the same time, policy incentives such as tax reductions and R&D subsidies will be provided to enterprises that actively adopt sustainable certifications such as FSC or invest in green digital technologies, in order to reduce the initial transformation costs of enterprises and amplify the promoting effect of digital transformation on sustainable competitiveness.

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