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An Analysis of Business Model Innovation Through the Digital Transformation of Household Appliance Manufacturing Companies in Shandong, China

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ABSTRACT

This study intends to analyze the influence of digital transformation on Shandong home appliance manufacturing companies' business model innovation. Specifically, the study presented the profile of the household appliance manufacturing companies, the extent of business model innovation, and level of digital transformation adoption. The study intends to analyze the effect of digital transformation to business model innovation. Also, this aims to know which among the factors significantly effect on business model innovation. The study determines the significant differences in the assessments of respondents when grouped according to profile. The study intends to propose a business innovation program for household appliance manufacturing companies. The study utilized descriptive research method. A total of 81 companies were the target respondents out of 101 total number of companies. The impact of product supply, customers, resources, capabilities, and strategies on business model innovation were deeply analyzed, including value proposition, operational value, human capital, and financial value. The data results met the reliability and validity requirements. This study used frequency, percentage, mean and regression analysis. The study revealed that most of the household appliance manufacturing companies have more than 50 employees and 4-5 years in business operation. There is very great extent of business model innovation in operational value, human capital, and financial value while great extent in value proposition. There is very high digital transformation with regards to product offering, customers, resources, capabilities, and strategy. Digital transformation has significant effect to business model innovation. The strategy significantly affects the business model innovation the most. There is no significant difference on the assessment of the respondents when grouped according to profile. The study proposed a Business Innovation Program for the household manufacturing companies in Shandong, China.

KEYWORDS

Business Model Innovation; Digital Transformation; Household Appliance Manufacturing Companies

1. INTRODUCTION

China's industrial industry has grown rapidly since the start of the reform and opening-up policy in 1978. Of them, the home appliance industry has attracted a lot of attention because it is a crucial part of manufacturing. Traditional home appliance manufacturers are facing increased market rivalry and the need for adaptable change due to the rapid growth and incorporation of digital technology. As a result, in the midst of the continuous digital transformation process, home appliance businesses are faced with the pressing need for business model innovation.

Chinese home appliance chain companies have experienced tremendous growth in the last few years, as evidenced by a considerable uptick in sales volume and a noteworthy improvement in their place in the global market. However, in the face of escalating rivalry in the global home appliance market, Chinese companies are found to be short on high-end branded product marketing techniques and poor on product quality.

Home appliance distributors use their channel advantages to shift marketing costs onto suppliers, forcing them to compete on price and forcing home appliance producers into a period of low-profit margins. This makes it harder to maintain long-term company competitiveness and increases the friction between distributors and manufacturers, who struggle with a lack of funding for R&D, loss of control over distribution channels, and end-user preferences. The main obstacles that home appliance producers must overcome are price wars, oversaturation of the market, and limited liquidity. For this reason, it is still crucial for Chinese home appliance companies to improve and innovate their business models and protocols. One of China's leading manufacturing centers, Shandong stands out for its highly developed industrial infrastructure and dense population. It is at the forefront of the country's manufacturing capabilities. With a large number of home appliance businesses, it is a key location for the manufacture and delivery of home appliances around the country. Making the most of the general acceptance of digital technologies, Shandong's manufacturing and related industries have experienced revolutionary changes.

In addition to increasing production efficiency, digital technologies have sparked paradigm changes in conventional business structures. When it comes to the manufacturing of home appliances, the rapid implementation of internet technologies has forced traditional manufacturers to adopt intelligent production methodologies. These methodologies use information technology to identify and respond to user needs instantly, allowing for customized and demand-driven production. This shortens the time it takes for a product to go from manufacturing to the customer, making it smarter, more affordable, and more accessible. As a result, demand is heightened. As a result, conventional manufacturing companies need to strategically implement digital transformations in order to implement full business model changes and strengthen their position in the market.

For this study, 81 home appliance manufacturing companies in Shandong Province were surveyed and interviewed. The difficulties Shandong's home appliance companies were having in coming up with new business models during the process of digital transformation have been clarified and addressed through thorough investigation. The proliferation of digital technology presents traditional home appliance producers with increasing market rivalry and changing consumer demands. Therefore, the purpose of this study is to analyze the business model innovation problems faced by Shandong's home appliance companies and provide adapted solutions while also exploring the complexity of their digital transformation process.

Since the market economic system was established, novel forms of retail have emerged along with the progressive formation of the buyer's market and the ongoing evolution and expansion of Western advanced company concepts and management techniques. Chinese household appliance manufacturers have grown quickly, starting small and working their way up to larger dimensions. China's home appliance market witnessed a shift from small-scale production rivalry to monopolistic competition dominated by a few big home appliance companies, caused by the use of digital technologies and dynamic business model innovation. These big retailers are now recognized as pioneers in digital transformation and novel business models. The home appliance industry has gradually been more open to foreign competition, especially after China joined the WTO. As a result, global home appliance retailers have ventured into the Chinese market to take on local businesses. By diversifying their product offerings, domestic businesses have increased their profit margins by reaching new customer demographics.

There is, however, limited potential for profit development due to the uniformity of the product, the lack of client segmentation, and the unfulfilled specific wants of the customers. Home appliance

businesses have expanded their operations by implementing a "quasi-financial model" in terms of profit models. However, as a result of supplier payment delays, disputes have gotten worse. For Shandong home appliance companies to increase profit leverage, they must improve information systems, logistics distribution, and customer service management. Products and services are susceptible at the same time because they lack core competitiveness, are easy for rivals to copy, and have low barriers to entrance into the market.

Shandong home appliance manufacturing companies are facing two types of competition as China's economy becomes more integrated: the influence of global home appliance giants and local rivals. Businesses must improve core competitiveness, restructure business models, and develop spanning competitive advantages in order to combat competitive challenges. As a result, Shandong home appliance manufacturing companies need to work with downstream vendors to secure sales, actively create operating profits through services and products, and use unique approaches to increase the added value of profits in terms of brands, products, and customer loyalty.

Companies in Shandong's home appliance manufacturing sector need to innovate their business models in order to maintain a competitive edge. Digital transformation is thought to be the most efficient way to accomplish increased productivity, operational efficiency, and business model innovation in the context of business model innovation.

In the study of Botha, Schachtebeck, Nieuwenhuizen & Bossink (2020), business model innovation should be pursued through digital transformation. Firstly, it identifies the basic structure of the three concepts of digitalization, digital transformation, and BMI in the literature and the commonalities between them. Secondly, this paper improves understanding of the concepts of digital transformation and BMI by developing a framework that illustrates how enterprises digitally transform elements of their business models, leading to BMI.

According to the research by Ramdani, Binsaif, and Boukrami (2019), business model innovation includes four areas: value proposition, operational value, human capital, and financial value. Digital transformation involves product offering, customers, resources, capabilities, and strategy.

First, regarding product offering, organizations should focus on how to develop new products or adapt existing ones through digital infusion. Second, it is necessary to explore how digital technologies can better serve customers, also known as digital customers. According to Gartner (2020), a digital customer is someone who uses technology to buy and sell products and services. Third, resources are critical in this process. This means that businesses must possess the necessary resources to integrate digital technologies into their business models. Fourth, businesses need to assess whether they have the necessary capabilities to ensure digital transformation and business model innovation or if existing capabilities can be transformed into digital capabilities. This is considered a key factor in digitalization and digital transformation. Lastly, the strategy needs to be adjusted to include digital technologies. This is known as a digital business strategy, defined in the literature as a unique business strategy formulated and executed by leveraging digital technologies (Bharadwaj et al., 2013).

2. OBJECTIVES

This study aims to investigate business model innovation in the digital transformation of Shandong household appliance manufacturing companies. Specifically, this study aims to:

(1) What is the profile of household appliance manufacturing companies in terms of the following:

1.1 number of employees; and

1.2 number of years in operation?

(2) To what extent does household appliance manufacturers practice business model innovation in terms of:

2.1 value proposition;

2.2 operational value;

2.3 human capital; and

2.4 financial value?

(3) What is the level of digital transformation adoption among household appliance manufacturers in terms of:

3.1 product offering;

3.2 customers;

3.3 resources;

3.4 capabilities; and

3.5 strategy?

(4) Does digital transformation significantly affect business model innovation?

The study tested the hypotheses below:

H_{o1}: Digital transformation adoption does not significantly affect business model innovation.

H_{o2}: There is no significant difference on the assessment of respondents when grouped according to profile.

3. MATERIALS AND METHODS

Descriptive correlational research design is a type of non-experimental research used to describe the characteristics of a population or phenomenon and examine the relationships between variables. This design does not involve manipulating variables but instead focuses on observing and measuring them as they naturally occur.

The researcher chose a descriptive study as it aims to accurately and systematically describe a population, situation, or phenomenon (McCombes, 2023). Descriptive methods help determine circumstances and causes based on study requirements. Document analysis using interpretive data was conducted to enhance information accuracy.

The respondents of this survey are home appliance manufacturers in Shandong Province. These include operations managers of household appliances manufacturers such as televisions, washing machines, and air conditioners. They understand the market very well, are sensitive to the digital transformation of Shandong home appliance companies, and have deep experience and feelings about the business model under digital transformation. They are manufacturers of home appliance manufacturing companies.

According to the statistical list of the Shandong Home Appliances Industry Association, the effective number of Shandong home appliance manufacturing companies is 101, This selected 81 manufacturing companies as research objects. The researchers used the Raosoft sample size calculator to obtain the sample size for this study. Frequency, percentage, mean and multiple regression, quantile regression analyses, Kruskal wallis, and ANOVA were finally used in this study.

4. RESULTS AND DISCUSSION

The home appliance manufacturing companies are known for their extensive product ranges, commitment to innovation, and focus on quality and customer satisfaction. The study describes the number of employees and years in operations of the companies.

Table 1. Scoring and interpretation

Range	Level	Extent
6.50-7.00	Extremely High	To an extremely great extent
5.50-6.49	Very High	To a very great extent
4.50-5.49	High	To a great extent
3.50-4.49	Average	To a moderate extent
2.50-3.49	Low	To a least extent
1.50-2.49	Very Low	To a very least extent
1.00-1.49	Extremely Low	None at all

4.1. Business Profile of Home Appliance Manufacturing Companies

Table 2 provides the distribution of home appliance manufacturing companies based on their size, measured by the number of employees.

Table 2. Distribution of the number of employees in the home appliance manufacturing companies

Size	Frequency	Percent
1-10 Person	18	22.22
11-30 Person	18	22.22
31-50 Person	11	13.58
More than 50	34	41.98
Total	**81**	**100.00**

From the data analyzed, it can be seen that there are notable differences in the size of enterprises in Shandong home appliance manufacturing enterprises. Companies with more than 50 employees account for the largest proportion with a frequency of 34 (41.98%), indicating that these companies represent a significant portion of the surveyed enterprises. This prevalence of larger companies may be attributed to their access to more resources and market share in the home appliance manufacturing industry. The proportion of companies with 1-10 employees and 11-30 employees is similar, both at 22.22%, with a frequency of 18. This shows that small and medium-sized companies account for a large proportion of the surveyed samples, which may represent start-ups and small and medium-sized enterprises in the industry. In contrast, companies with 31-50 employees account for the least proportion with a frequency of 11, only 13.58%. These often occupy a middle ground, balancing the benefits of being small enough to remain agile and innovative with the challenges of scaling and competing in a market dominated by larger firms. Their success often hinges on their ability to leverage their specialization, adapt to market changes, and maintain strong customer relationships.

Table 3 shows the distribution of home appliance manufacturing companies based on their number of years in operation.

Table 3. Data distribution by number of years in operation

Year	Frequency	Percent
less than 1 year	13	16.05%
1-3 years	13	16.05%
4-5 years	54	66.67%
More than 5 years	1	1.23%
Total	**81**	**100%**

The companies with 4-5 years of operation have the highest frequency, with 54 companies, representing 66.67% of the sample. This dominant proportion suggests that a significant majority of companies in the industry have been in operation for 4 to 5 years. These companies are likely to be more established compared to newer firms but are not yet in the long-term phase of operation. They are also relatively more stable and established in the industry.

Another, the companies with less than 1 year and 1-3 years of operation are similar, both categories have a frequency of 13 and account for 16.05% of the total sample each. This indicates that a portion of the industry is composed of relatively new companies, either just starting out or within their initial years of operation. These newer firms may still be in the process of establishing their market presence and operational stability.

The companies with more than 5 years of operation have the least number with only 1 company, making up 1.23% of the sample. This very low proportion indicates that very few companies have been in operation for more than 5 years. This could suggest a high turnover rate or significant challenges in sustaining long-term operations in the industry.

4.2. Extent of Business Model Innovation among Home Appliance Manufacturers

Table 4 shows the extent of business model innovation in terms of value proposition.

Table 4. Extent of business model innovation in terms of value proposition

Items	Mean	SD	Interpretation
prompts the ability to proactively think and solve key issues	5.41	1.158	To a great extent
drives companies to produce products with core competitiveness	5.42	1.07	To a great extent
enables companies to more clearly meet customers' customized needs	5.35	1.162	To a great extent
makes it easier for the company to understand what customers really need	5.46	1.21	To a great extent
lies in the ability to accurately serve target customers	5.56	1.213	To a very great extent
prompts companies to serve target customers more carefully and thoughtfully	5.32	1.302	To a great extent
enables companies to serve customers better and more valuable	5.37	1.146	To a great extent
allows optimization and improvement of value proposition and/or business model	5.42	1.296	To a great extent
integrates customers, suppliers, distributors and other agents in innovative ways with business models related to product and service delivery	5.65	1.128	To a very great extent
enables the company to be more efficient and responsive to the needs of all stakeholders	5.41	1.285	To a great extent
Overall	**5.44**	**0.87**	**To a great extent**

Home appliance manufacturers appear to be significantly establishing their value propositions, as indicated by the composite mean of 5.44 for great extent of business model innovation. The comparatively higher mean suggests a considerable extent of innovation and adaptability in the way manufacturers showcase their offerings to customers. With the majority of businesses in the industry adhering carefully to improving their value propositions, the low standard deviation of 0.87 suggests even more industry consistency. Generally, this illustrates a solid industry trend toward redefining value and maintaining competitiveness via innovative business models.

The highest mean of 5.65 shows that home appliance manufacturers are innovating their business models to a very great extent, particularly when it comes to effectively integrating suppliers, distributors, customers, and other stakeholders. The development of value propositions that improve the delivery of both products and services reflects this significant level of innovation.

Table 5 shows the extent of business model innovation in terms of operational value.

The findings indicate that home appliance manufacturers view their operational value practices and strategies to a very great extent, as indicated by the composite mean score of 5.57. According to this evaluation there may be opportunities for improvement in some areas. The responses' considerable range, as indicated by the standard deviation of 0.794, suggests that views on effectiveness are generally consistent but not totally uniform.

Table 5. Extent of business model innovation in terms of operational value

Items	Mean	SD	Interpretation
helps partners improve operational efficiency	5.52	1.138	To a very great extent
helps partners quickly solve problems	5.48	1.216	To a great extent
encourages companies to develop a wider partner network	5.69	1.078	To a very great extent
drives companies to establish more online distribution channels	5.61	1.105	To a very great extent
promotes smoother online distribution channels for enterprises	5.44	1.082	To a great extent
has significantly improved the commodity circulation cycle	5.47	1.172	To a great extent
facilitates closer partnerships	5.67	1.073	To a very great extent
promotes significant improvement of the company's core values.	5.61	1.074	To a very great extent
makes enterprise production and operation processes more scientific	5.54	1.14	To a very great extent
makes company processes more efficient and convenient	5.65	1.182	To a very great extent
Overall	**5.57**	**0.794**	**To a very great extent**

This uniformity raises the possibility that defining best practices or focusing on particular areas where operational value could be increased would be beneficial for the industry. As per Ramdani, Binsaif, & Boukrami (2019), business model innovation can be accomplished by rearranging processes to lower transaction costs and concentrating on value creation. Innovation in this dimension, however, can be attained through resource configuration, which shows how a company can combine different assets in a way that fulfills its value proposition.

Manufacturers of home appliances appear to view expanding their partner network as a viable approach, as seen by the highest mean score of 5.69 in the operational value evaluation with a very great extent. This shows that even if the strategy is usually regarded as advantageous, it can still be enhanced or optimized.

Table 6 shows the extent of business model innovation in terms of human capital.

Table 6. Extent of business model innovation in terms of human capital

Items	Mean	SD	Interpretation
support the training and development of employees	5.6	1.168	To a very great extent
promotes communication among employees is smoother and more efficient.	5.56	1.109	To a very great extent
improves the optimal allocation of human resources in enterprises	5.59	1.128	To a very great extent
creates a more scientific and reasonable team size and structure	5.75	1.199	To a very great extent
makes the company more attractive to high-end talents	5.68	1.039	To a very great extent
increases employee satisfaction	5.51	1.235	To a very great extent
develops team collaboration efficiency measurement	5.8	1.041	To a very great extent
improves employees' innovation capabilities in terms of R&D results and other aspects	5.63	1.009	To a very great extent
expands the academic qualifications and experience of the company's recruiters	5.61	1.143	To a very great extent
improves return on investment in human capital compared to last year	5.86	0.953	To a very great extent
Overall	**5.66**	**0.745**	**To a very great extent**

According to the composite mean of 5.66 for evaluating human capital with a very great extent among home appliance manufacturers, employees in the sector are typically thought to be fairly effective. This rating shows that although the present workforce has certain strengths, more may be done to improve performance as a whole.

The effectiveness of human capital among home appliance manufacturers was evaluated, and the highest mean score of 5.86 shows to a very great extent. This mean, together with a 0.953 standard deviation, indicates that the industry as a whole may perceive this improvement in a very uniform

manner. The significance of ongoing investments in human resources to maximize performance and profitability is highlighted by this evaluation.

Table 7 shows the extent of business model innovation in terms of financial value.

Table 7. Extent of business model innovation in terms of financial value

Items	Mean	SD	Interpretation
Increases the company's operating income	5.6	1.195	To a very great extent
Reduces the company's operating costs	5.57	1.067	To a very great extent
Makes cash flow smoother	5.41	1.211	To a great extent
Increases the company's capital turnover rate	5.62	1.103	To a very great extent
Promotes a more reasonable asset-liability ratio	5.54	1.313	To a very great extent
Makes corporate asset-liability ratios reasonable	5.63	1.177	To a very great extent
Makes financial risks more controllable	5.53	1.22	To a very great extent
Increases the company's net profit	5.47	1.146	To a great extent
Increases the company's shareholder equity ratio	5.5	1.277	To a very great extent
Strengthens the company's profitability	5.61	1.252	To a very great extent
Overall	**5.55**	**0.893**	**To a very great extent**

The composite means of 5.55 along with a standard deviation of 0.893, appears that the enterprise's financial value is viewed to a very great extent. Although there are some positive points about the financial evaluation, there is still space for development, as indicated by the mean score. The comparatively low standard deviation indicates that there is little difference in the evaluators' assessments, and responses are often consistent. Thus, the study shows that the enterprise's financial value evaluation techniques are stable but not very effective. As per Johnson (2023), one important subset of business model innovation is financial value, which focuses on creative financial techniques that businesses can use to improve their financial performance. The use of subscription-based business models, which boost client lifetime value and offer a consistent revenue stream, is one successful strategy.

A relatively good corporate asset-liability ratio is indicated by the highest mean of 5.63 in the evaluation of the financial value among home appliance manufacturers to a very great extent. This figure shows that the manufacturers' financial management practices are, generally, adequate at keeping the ratio of assets to liabilities in check.

4.3. Level of Digital Transformation Adoption among Home Appliance Manufacturers

Table 8 presents the level of digital transformation adoption in terms of product offering.

The study presents the composite mean of 5.5 with very high digital transformation in product offering. The standard deviation is 0.752 in which most responses fall within a range close to the mean. A very high product offering for home appliance manufacturing companies is characterized by a range of features and attributes that align with consumer needs and market trends. Digital transformation is a critical strategy for home appliance manufacturing companies to stay competitive in a rapidly evolving market. By embracing digital technologies, companies can enhance operational efficiency, drive innovation, improve customer engagement, and achieve sustainability goals. However, they must also address the associated challenges to fully realize the benefits of digital transformation.

Table 8. Level of digital transformation adoption in terms of product offering

Items	Mean	SD	Interpretation
empowers product production and makes overall operations more cost-effective.	5.54	1.101	Very High
mproves market development efficiency	5.42	1.188	High
greatly improves production efficiency	5.53	1.247	Very High
s very effective in reducing operating costs	5.42	1.198	High
significantly improves product quality	5.61	1.178	Very High
uses different types of digital tools or platforms to produce products	5.5	1.168	Very High
ncreases efficiency and transparency in supply chain management	5.52	1.181	Very High
uses data analysis to accurately analyze and optimize production processes.	5.72	1.063	Very High
s one important aspect in business decision-making	5.64	1.177	Very High
Overall	**5.55**	**0.752**	**Very High**

The companies use data analysis to accurately analyze and optimize production processes with the highest mean of 5.72 and standard deviation of 1.063. This suggests that companies perceive data analysis as a crucial and effective tool for improving production efficiency.

Table 9 presents the level of digital transformation adoption in terms of customers.

Table 9. Level of digital transformation adoption in terms of customers

Items	Mean	SD	Interpretation
aids to meet customers' customized needs	5.61	0.998	Very High
meets the individual requirements of enterprises	5.64	1.174	Very High
greatly improves customer satisfaction	5.62	1.001	Very High
greatly increases its connections with customers	5.69	1.152	Very High
provides timely customer feedback	5.62	1.125	Very High
led to customers who are more willing to accept product Customization	5.71	1.235	Very High
makes it easier for customers to use products	5.75	1.166	Very High
solves customers' after-sales problems as quickly as possible	5.7	1.31	Very High
provides production orders that are planned and produced according to the actual needs of customers	5.57	1.115	Very High
makes purchase and use of products quick and easy for customers	5.76	1.113	Very High
Overall	**5.67**	**0.759**	**Very High**

The composite mean score of 5.67, with a standard deviation of 0.759, represents the overall level of digital transformation adoption by home appliance manufacturers with respect to customer interactions and services. The verbal interpretation of "very high" indicates a strong overall adoption of digital transformation practices in this context. This indicates that home appliance manufacturers are effectively utilizing digital technologies to enhance customer engagement, service, and overall experience. High adoption of digital transformation in customer interactions can provide manufacturers with a competitive edge by offering superior customer service, personalized experiences, and efficient processes.

The highest mean of 5.76 indicates that respondents perceive a very high level on how digital transformation has made the purchase and use of products quick and easy for customers. This suggests that digital tools and technologies are significantly improving the efficiency and convenience of both the purchasing process and product usage.

Table 10 presents the level of digital transformation adoption in terms of resources

The composite means of 5.66 indicates that, on average, respondents perceive a very high level of digital transformation adoption in the management of resources. This suggests that digital technologies are highly effective in enhancing resource management practices. The very high mean score suggests that digital transformation is generally seen as very effective in managing resources, providing significant benefits in efficiency and effectiveness.

Table 10. Level of digital transformation adoption in terms of resources

Items	Mean	SD	Interpretation
makes it easier for enterprises to obtain more comprehensive operational data	5.72	1.176	Very High
enhances the overall competitiveness of enterprises	5.81	1.069	Very High
optimizes supply chain management capabilities	5.63	1.176	Very High
enables enterprises to adjust the resource allocation of production lines in real time according to market demand and production plans, including personnel, equipment, raw materials, etc., to achieve optimal allocation and efficient utilization of resources.	5.65	1.084	Very High
provides enterprises with more innovation opportunities and means	5.77	1.142	Very High
simplifies working relationships with suppliers	5.47	1.161	High
eases fast communication between enterprises and customers	5.62	1.195	Very High
facilitates collaboration among different stakeholders	5.72	1.028	Very High
makes it easier for businesses to share information and resources	5.49	1.183	High
makes it easier for enterprises to achieve business collaboration	5.71	1.109	Very High
Overall	**5.66**	**0.763**	**Very High**

With the highest mean of 5.81 in the adoption level of digital transformation, businesses have incorporated digital resources to a very high level. The significant adoption of digital tools and technologies by businesses is indicative of their efforts to optimize their workflows, optimize procedures, and boost productivity.

Table 11 presents the level of digital transformation adoption in terms of capabilities.

Table 11. Level of digital transformation adoption in terms of capabilities

Items	Mean	SD	Interpretation
makes the production process intelligent through automation, robotics and advanced algorithms, improving production efficiency and product quality	5.57	1.093	Very High
helps achieve sustainable development goals such as energy conservation, emission reduction, and resource recycling, and enhances corporate social responsibility and brand image	5.55	1.118	Very High
achieves cross-department, cross-enterprise, and cross-industry collaboration	5.4	1.242	High
uses big data and artificial intelligence technology for precision marketing to improve market coverage and marketing effectiveness	5.78	1.023	Very High
achieves transparency and optimization of the supply and improves the flexibility and response speed of the supply chain	5.61	1.194	Very High
uses intelligence and IoT technologies to provide intelligent services such as remote monitoring, fault diagnosis, and automatic maintenance	5.24	1.293	High
uses digital transformation technology to provide personalized products and services to meet the diverse needs of consumers	5.63	1.244	Very High
uses digital tools to collect and analyze customer feedback, understand customer needs and preferences, and optimize products and services	5.66	1.076	Very High
uses big data analysis technology to extract valuable information from massive data to support corporate decision-making and optimize production and operation strategies	5.54	1.302	Very High
provides more opportunities and means for innovation	5.57	1.075	Very High
Overall	**5.56**	**0.789**	**Very High**

The composite means of 5.56 shows a high level of adoption of digital transformation regarding capabilities. An effective integration of digital tools and practices across the business is reflected in this mean score, which is regarded as good. With little variation in the perception or use of digital

transformation capabilities, the comparatively low standard deviation of 0.789 indicates that this degree of adoption is constant across various sectors or companies. Based on the data, digital technologies are being adopted steadily and effectively, which is helping to modernize and increase operational efficiency.

The highest mean of 5.78 suggests a high level of digital transformation adoption concerning big data and artificial intelligence technologies for precision marketing. This high mean is a good interpretation, indicating that businesses are successfully incorporating these technologies to expand their market reach and improve their marketing efficacy.

Table 12 presents the level of digital transformation adoption in terms of strategy.

Table 12. Level of digital transformation adoption in terms of strategy

Items	Mean	SD	Interpretation
provides a variety of digital solutions	5.5	1.199	Very High
in digital transformation, employees prioritize the use of digital technologies when considering ways to improve	5.48	1.208	High
automates and digitizes the core operational processes	5.55	1.237	Very High
helps managers in monitoring company operations in real time	5.42	1.211	High
in digital transformation, transactions between enterprises and suppliers have become digital	5.54	1.223	Very High
promotes the establishment of enterprise standardization processes	5.61	1.233	Very High
provides timely and accurate data to different users for better analysis and decisions	5.42	1.256	High
ability to systematically collect and analyze various data required for business operations	5.59	1.213	Very High
promotes the strengthening of organizational management and learning culture	5.46	1.133	High
drives values of transparency and openness	5.57	1.207	Very High
promotes development of tools that are more conducive to team communication and collaboration	5.63	1.29	Very High
Overall	**5.53**	**0.855**	**Very High**

A good level of integration across businesses is indicated by the composite mean of 5.53 for the adoption of digital transformation as it relates to strategy. This rating indicates a typically positive outlook and skill in using digital strategies. While the majority of companies are successfully implementing digital transformation strategies, there are some disparities in the scope and efficacy of these implementations, as indicated by the standard deviation of 0.855, which indicates a moderate amount of variability across the respondents. In general, the evidence suggests that strategic planning has a strong, though uneven, commitment to digital transformation.

4.4. Effect of Digital Transformation to Business Model Innovation

Table 13 presents the effect of digital transformation to business model innovation in terms of value proposition.

According to the regression results in Table 12, it presents a detailed analysis and explanation of the impact of digital transformation on the business model innovation of enterprises in terms of value proposition. An F-statistic of 53.2 with a p-value less than 0.001 indicates that the model is statistically significant, meaning that at least one of the predictors is significantly associated with the dependent variable. An Adjusted R^2 of 0.765 means that 76.5% of the variability in the dependent variable is explained by the model, which indicates a good fit. A standard error of 0.405 suggests that, on average, the observed values deviate from the predicted values by approximately 0.405 units. The result also shows no significant autocorrelation and heteroscedasticity.

Table 13. Effect of digital transformation to business model innovation in terms of value proposition

Variable	Coefficient	SE	t-stat	p-value	Decision to Ho	Interpretation	VIF
Intercept	-0.3453	0.402	-0.859	0.393	Failed to Reject	Not Significant	2.17
Product Offering	0.0598	0.0923	0.648	0.519	Failed to Reject	Not Significant	2.55
Customer	0.0536	0.0992	0.54	0.591	Failed to Reject	Not Significant	4.41
Resources	0.3052	0.1297	2.353	0.021	Reject	Significant	3.52
Capabilities	0.1904	0.112	1.699	0.093	Failed to Reject	Not Significant	4.04
Strategy	0.4276	0.1107	3.862	< .001	Reject	Significant	
F-statistics = 53.2		p-value = <.001		Adjusted R2 = 0.765		Std. Error = 0.405	
Jarque-Bera (p-value) = 0.634		Durbin-Watson = 1.91 LL = 1.5105999 UL = 1.7724				Breush-Pagan (p-value) = 0.101	

In the table, the p-value of 0.021 was lower than 0.05 level of significance which indicates that digital transformation (capabilities) has significant effect to value proposition. Thus, it rejects the null hypothesis. This reflects that the digital transformation capabilities do have a significant impact on the value proposition. This means that improvements or changes in digital transformation capabilities are associated with changes in the value proposition offered by the business. The significant effect implies that businesses that invest in and enhance their digital transformation capabilities may be able to improve their value proposition, potentially leading to better competitive positioning, customer satisfaction, and overall business performance.

Another, the p-value of <.001 was less than the 0.05 level of significant which shows the effect of digital transformation (strategy) to value proposition. Thus, it rejects the null hypothesis. This indicates that there is very strong statistical evidence to suggest that digital transformation strategy has a significant effect on the value proposition. This indicates that there is very strong statistical evidence to suggest that digital transformation strategy has a significant effect on the value proposition. The significant effect suggests that businesses that effectively develop and implement digital transformation strategies can enhance their value proposition. This could lead to improved customer experiences, increased efficiency, and better market positioning.

Moreover, digital transformation with the p-value of 0.519 on product offering, 0.591 on customer, and 0.093 on capabilities were all higher that .05 level of significance. This revealed that digital transformation in product offering, customer, and capabilities have no significant effect to business model innovation, particularly to value proposition. Thus, the study failed to reject the null hypothesis. It posits that digital transformation has no significant effect on the value proposition components of business model innovation.

Table 14 presents the effect of digital transformation to business model innovation in terms of operational value.

Table 14. Effect of digital transformation to business model innovation in terms of operational value

Variable	Coefficient	SE	t-stat	p-value	Decision to Ho	Interpretation	VIF
Intercept	0.51537	0.3903	1.3205	0.191	Failed to Reject	Not Significant	2.17
Product Offering	-0.02856	0.0896	-0.319	0.751	Failed to Reject	Not Significant	2.55
Customer	0.20824	0.0963	2.1628	0.034	Reject	Significant	4.41
Resources	-0.00241	0.1259	-0.019	0.985	Failed to Reject	Not Significant	3.52
Capabilities	0.27284	0.1088	2.5085	0.014	Reject	Significant	4.04
Strategy	0.45774	0.1075	4.2584	< .001	Reject	Significant	2.17
F-statistics = 45.4		p-value = <.001		Adjusted R2 = 0.753		Std. Error = 0.394	
Jarque-Bera (p-value) = 0.634		Durbin-Watson = 1.97 LL = 1.5105999 UL = 1.7724				Breush-Pagan (p-value) = 0.060	

The table discussed the analysis and explanation of the impact of digital transformation on the business model innovation of enterprises in terms of operational value. An F-statistic of 45.54 with a p-value less than 0.001 indicates that the model is statistically significant, meaning that at least one of the predictors is significantly associated with the dependent variable. An Adjusted R^2 of 0.753 means that 75.3% of the variability in the dependent variable is explained by the model, which indicates a good fit. A standard error of 0.394 suggests that, on average, the observed values deviate from the predicted values by approximately 0.394 units. The result also shows no significant autocorrelation and heteroscedasticity.

In the table, the p-value of 0.034 was lower than 0.05 level of significance which indicates that digital transformation (customer) has significant effect to operational value. Thus, it rejects the null hypothesis. The null hypothesis in this context would state that digital transformation efforts focused on customers do not have a significant effect on the value proposition. This reflects that the digital transformation of customers does have a significant effect on the operational value. This means that improvements or changes in how the company engages with and serves its customers through digital means are associated with positive changes in the operational value proposition of the business. For household appliance manufacturing companies, focusing on digital transformation initiatives that enhance the customer experience can lead to significant improvements in the operational value of their business. This could involve the use of digital tools to better understand customer needs, provide personalized services, improve customer service efficiency, and enhance overall customer satisfaction.

Another, the p-value of 0.014 was less than the 0.05 level of significant which shows the effect of digital transformation (capabilities) to operational value. Thus, it rejects the null hypothesis. The results indicate that digital transformation initiatives aimed at improving the capabilities of the business have a statistically significant impact on the operational value offered by the household appliance manufacturing companies. This means that enhancements or changes in the company's capabilities through digital means are associated with positive changes in the operational value of the business. For household appliance manufacturing companies, focusing on digital transformation initiatives that enhance business capabilities can lead to significant improvements in operational value. This could involve adopting advanced manufacturing technologies, improving supply chain management through digital tools, enhancing production efficiency, and leveraging data analytics for better decision-making.

Moreover, the p-value of <.001 was less than the 0.05 level of significant which shows the effect of digital transformation (strategy) to operational value. Thus, it rejects the null hypothesis. The results indicate that digital transformation strategies have a statistically significant and positive impact on the operational value offered by household appliance manufacturing companies. This means that the adoption and implementation of digital transformation strategies are strongly associated with improvements in the operational value of the business. For household appliance manufacturing companies, focusing on comprehensive digital transformation strategies can lead to significant enhancements in operational value. This could involve developing and implementing strategic initiatives such as integrating advanced technologies into production processes, adopting digital supply chain management practices, leveraging data analytics for operational efficiency, and continuously innovating through digital means.

Moreover, digital transformation with the p-value of 0.751on product offering and 0.985 on resources were higher that .05 level of significance. This revealed that digital transformation in product offering and resources have no significant effect to business model innovation, particularly to operational value. Thus, the study failed to reject the null hypothesis. It concludes that businesses might need to consider other areas or different approaches within digital transformation to see significant changes in their operational value.

Table 15 shows the effect of digital transformation to business model innovation in terms of human capital.

Table 15. Effect of digital transformation to business model innovation in terms of human capital

Variable	Coefficient	SE	t-stat	p-value	Decision to Ho	Interpretation	VIF
Intercept	0.9359	0.4234	2.211	0.03	Reject	Significant	2.17
Product Offering	-0.0737	0.0972	-0.758	0.451	Failed to Reject	Not Significant	2.55
Customer	0.2634	0.1044	2.522	0.014	Reject	Significant	4.41
Resources	0.2986	0.1366	2.186	0.032	Reject	Significant	3.52
Capabilities	0.2282	0.118	1.935	0.057	Failed to Reject	Not Significant	4.04
Strategy	0.1232	0.1166	1.057	0.294	Failed to Reject	Not Significant	2.17
F-statistics = 30.01		p-value = <.001		Adjusted R^2 = 0.645		Std. Error = .427	
Jarque-Bera (p-value) = 0.240		Durbin-Watson = 2.07 LL = 1.5105999 UL = 1.7724				Breush-Pagan (p-value) = 0.062	

The table discussed the analysis and explanation of the impact of digital transformation on the business model innovation of enterprises in terms of human capital. An F-statistic of 30.01 with a p-value less than <0.001 indicates that the model is statistically significant, meaning that at least one of the predictors is significantly associated with the dependent variable. An Adjusted R^2 of 0.645 means that 64.5% of the variability in the dependent variable is explained by the model, which indicates a good fit. A standard error of 0.427 suggests that, on average, the observed values deviate from the predicted values by approximately 0.427 units. The result also shows no significant autocorrelation and heteroscedasticity.

In the table, the p-value of 0.014 was lower than 0.05 level of significance which indicates that digital transformation (customer) has significant effect to human capital. Thus, it rejects the null hypothesis. The results indicate that digital transformation initiatives aimed at enhancing customer interactions, experiences, and relationships have a statistically significant impact on human capital. This means that improvements or changes in how the company engages with and serves its customers through digital means are associated with positive changes in the skills, knowledge, and capabilities of the workforce. For household appliance manufacturing companies, focusing on digital transformation initiatives that enhance customer experiences can lead to significant improvements in human capital. This could involve the use of digital tools to better understand customer needs, provide personalized services, and improve customer service efficiency, all of which can enhance employee skills and knowledge.

Another, the p-value of 0.032 was less than the 0.05 level of significant which shows the effect of digital transformation (resources) to human capital. Thus, it rejects the null hypothesis. The results indicate that digital transformation initiatives aimed at improving resources have a statistically significant impact on human capital. This means that enhancements or changes in the resources available to the company through digital transformation are associated with positive changes in the skills, knowledge, and capabilities of the workforce. For household appliance manufacturing companies, focusing on digital transformation initiatives that improve resources can lead to significant improvements in human capital. This could involve investing in advanced manufacturing technologies, upgrading digital tools and platforms, and optimizing resource management processes. These improvements can enhance employees' ability to perform their tasks effectively and efficiently, leading to better skill development and knowledge acquisition.

However, digital transformation with the p-value of 0.451on product offering, 0.057 on capabilities, and 0.294 on strategy were all higher that .05 level of significance. Thus, the study failed to reject the null hypothesis. This explains that posits that digital transformation has no significant effect on product offering, capabilities, or strategy.

Table 16 presents the effect of digital transformation to business model innovation in terms of financial value.

Table 16. Effect of digital transformation to business model innovation in terms of financial value

Variable	Coefficient	SE	t-stat	p-value	Decision to Ho	Interpretation	VIF
Intercept	-0.141	0.522	-0.27	0.788	Failed to Reject	Not Significant	2.17
Product Offering	0.1976	0.12	1.647	0.104	Failed to Reject	Not Significant	2.55
Customer	0.1891	0.129	1.467	0.147	Failed to Reject	Not Significant	4.41
Resources	0.0777	0.169	0.461	0.646	Failed to Reject	Not Significant	3.52
Capabilities	0.2505	0.146	1.72	0.089	Failed to Reject	Not Significant	4.04
Strategy	0.3059	0.144	2.126	0.037	Reject	Significant	2.17
F-statistics = 27.5		p-value=<.001		Adjusted R2 = 0.647		Std. Error = 0.527	
Jarque-Bera (p-value) = 214		Durbin-Watson = 1.778 LL = 1.5105999 UL = 1.7724				Breush-Pagan (p-value) = 0.070	

The study presents the analysis of the effect of digital transformation on the business model innovation of enterprises in terms of financial value. An F-statistic of 27.5 with a p-value less than <0.001 indicates that the model is statistically significant, meaning that at least one of the predictors is significantly associated with the dependent variable. An Adjusted R^2 of 0.647 means that 64.7% of the variability in the dependent variable is explained by the model, which indicates a good fit. A standard error of 0.527 suggests that, on average, the observed values deviate from the predicted values by approximately 0.527 units. The result also shows no significant autocorrelation and heteroscedasticity.

In the table, the p-value of 0.037 was lower than 0.05 level of significance which indicates that digital transformation (strategy) has significant effect to financial value. Thus, it rejects the null hypothesis. The significant p-value indicates that digital transformation strategies have a meaningful impact on the financial value of the company. This means that implementing and leveraging digital transformation strategies is associated with positive changes or improvements in the financial outcomes of the business. For household appliance manufacturing companies, this result suggests that investing in and focusing on digital transformation strategies can lead to improved financial performance. These strategies might involve adopting new technologies, improving digital processes, or enhancing data analytics capabilities, all of which can contribute to better financial results, such as increased revenue, reduced costs, or improved profitability.

However, digital transformation with the p-value of 0.104 on product offering, 0.147 on customers, 0.646 on resources, and 0.089 on capabilities were all higher that .05 level of significance. Thus, the study failed to reject the null hypothesis. This explains that businesses might need to consider other strategies or focus areas to enhance their product portfolio. Additional measures might be needed to enhance customer-related outcomes and businesses may need to explore other ways to optimize resources. Also, companies might need to integrate digital transformation more deeply or adopt different approaches.

5. CONCLUSIONS

Upon completion, the researchers concluded:

(1) Most of the household appliance manufacturing companies have more than 50 employees and 4-5 years in business operation.

(2) There is very great extent of business model innovation in operational value, human capital, and financial value while great extent in value proposition.

(3) There is very high digital transformation with regards to product offering, customers, resources, capabilities, and strategy.

(4) Digital transformation has significant effect to business model innovation.

6. RECOMMENDATIONS

The researchers make the following recommendations based on their findings:

(1) The study proposed to disseminate the information about the proposed business innovation program among household appliance manufacturing companies in Shandong, China.

(2) The operations manager of the household appliance manufacturing companies may consider the effective use of resources such as technology, talents, and assets which can help enterprises create more innovative and competitive products or services, meet customer needs, and achieve business goals.

(3) The future researchers may conduct the same study with other innovation-driven industries.

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