

TECHNOLOGY ADOPTION IN TRADITIONAL HANDLOOM INDUSTRIES

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Abstract

The traditional handloom industry represents one of the oldest and most culturally significant sectors of the global textile economy. Besides preserving indigenous craftsmanship and cultural heritage, the handloom sector provides livelihood opportunities to millions of artisans, particularly in rural and semi-urban regions. However, increasing market competition, changing consumer preferences, globalization, and rapid technological advancements have created significant challenges for traditional handloom enterprises. The adoption of modern technologies, including computer-aided design (CAD), digital weaving tools, e-commerce platforms, digital payment systems, enterprise resource planning, and social media marketing, has emerged as a promising strategy for improving productivity, product quality, operational efficiency, and market competitiveness. Despite these opportunities, technology adoption among traditional handloom industries remains uneven due to financial constraints, limited technical knowledge, inadequate infrastructure, and resistance to organizational change.

*The present study investigates the extent of technology adoption in traditional handloom industries and evaluates its influence on production efficiency, business performance, market expansion, artisan income, and long-term sustainability. A quantitative, descriptive, and cross-sectional research design was adopted. Primary data were collected from **250 respondents**, including handloom weavers, cooperative members, entrepreneurs, and small-scale business owners, using a structured questionnaire based on a five-point Likert scale. Descriptive and inferential statistical techniques, including frequency analysis, percentage analysis, mean, standard deviation, Pearson correlation, independent sample t-test, one-way ANOVA, and multiple regression analysis, were employed to evaluate the relationship between technology adoption and industrial performance.*

The findings reveal that technology adoption significantly improves production efficiency, product quality, market accessibility, customer satisfaction, and income generation. Digital marketing platforms and e-commerce applications have substantially expanded market opportunities for traditional artisans, while modern production technologies have reduced operational costs and production time. The study recommends strengthening digital literacy, improving financial support, expanding technological infrastructure, and implementing government-supported capacity-building programs to accelerate technology adoption and enhance the long-term sustainability of traditional handloom industries.

Keywords: Technology Adoption, Traditional Handloom Industry, Digital Transformation, Handloom Weavers, E-Commerce, Production Efficiency, Sustainable Textile Industry, Rural Entrepreneurship.

INTRODUCTION

The traditional handloom industry is one of the oldest forms of textile production and continues to play an important role in preserving cultural heritage, generating rural employment, and supporting local economic development. Handloom weaving represents not only an economic activity but also a symbol of traditional craftsmanship that has been transferred from one generation to another over several centuries. Countries such as India, Bangladesh, Nepal, Sri Lanka,

Indonesia, and several African nations possess rich handloom traditions that contribute significantly to their cultural identity and rural livelihoods. Millions of artisans depend directly or indirectly on handloom production for income generation, making this sector an important contributor to inclusive economic development and sustainable employment.

The rapid pace of globalization and industrialization has transformed the textile industry over the past few decades. Mechanized textile production, automation,

synthetic fabrics, and large-scale manufacturing have intensified competition for traditional handloom enterprises. Consumers increasingly demand high-quality products, faster delivery, innovative designs, and competitive prices, creating substantial pressure on traditional weavers operating with conventional production methods. Consequently, many handloom enterprises face declining productivity, rising production costs, shrinking profit margins, and limited access to national and international markets. These challenges have increased the importance of adopting modern technologies capable of improving productivity while preserving the unique artistic value of traditional handloom products.

Technology adoption has therefore become an essential strategy for strengthening the competitiveness and sustainability of traditional handloom industries. Modern technologies such as computer-aided design (CAD), computerized pattern development, digital color matching, improved weaving equipment, enterprise resource planning systems, digital payment technologies, social media marketing, and e-commerce platforms have significantly transformed textile production and marketing. These technologies enable artisans to improve product quality, reduce production time, minimize operational costs, expand customer reach, and respond more effectively to changing market demands. Furthermore, digital platforms provide direct access to consumers, reducing dependence on intermediaries and improving income opportunities for handloom producers.

The significance of technology adoption in traditional handloom industries can be understood through the following major aspects:

- Improvement in production efficiency and product quality.
- Reduction in production cost and operational time.
- Expansion of digital marketing and e-commerce opportunities.
- Enhancement of artisan income and employment generation.
- Preservation of traditional craftsmanship through modern innovation.
- Strengthening of rural entrepreneurship and local economic development.

- Promotion of sustainable textile production.
- Increased national and international market competitiveness.
- Government initiatives supporting digital transformation.
- Long-term sustainability of the handloom sector.

Despite the growing availability of technological innovations, the adoption of modern technologies within traditional handloom industries remains relatively limited. Financial constraints, inadequate digital infrastructure, lack of technical training, low educational attainment, resistance to technological change, and insufficient institutional support continue to restrict modernization efforts. Small-scale artisans often face difficulties in accessing affordable technologies and financial resources required for digital transformation. Additionally, concerns regarding the preservation of traditional weaving techniques sometimes discourage rapid technological adoption among experienced artisans.

Previous studies have extensively examined the economic importance of the handloom sector and the role of technology in industrial development. However, relatively limited empirical research has investigated the relationship between technology adoption and the overall performance of traditional handloom industries by simultaneously considering production efficiency, market expansion, business sustainability, and artisan income. Moreover, the influence of demographic characteristics and technological awareness on adoption behavior remains insufficiently explored, particularly in developing economies where traditional textile production continues to play a major socio-economic role.

Therefore, the present study aims to examine the level of technology adoption in traditional handloom industries and evaluate its influence on production efficiency, business performance, market accessibility, and long-term sustainability. The findings are expected to provide valuable insights for policymakers, textile entrepreneurs, cooperative societies, researchers, government agencies, and handloom artisans by identifying practical strategies capable of accelerating digital

transformation while preserving the cultural and economic significance of traditional handloom industries.

RESEARCH DESIGN

The present study employed a quantitative, descriptive, and cross-sectional research design to examine the extent of technology adoption in traditional handloom industries and its influence on production efficiency, business performance, market accessibility, and long-term sustainability. A quantitative research design was considered appropriate because it facilitates the systematic collection of measurable data from respondents and enables statistical evaluation of the relationship between technology adoption and industrial performance. The descriptive nature of the study provides a comprehensive understanding of the technological practices adopted by traditional handloom enterprises without manipulating any variables, while the cross-sectional approach captures respondents' perceptions during a specific period of investigation.

The study focused on traditional handloom weavers, cooperative members, entrepreneurs, and business owners engaged in handloom production across selected regions. A structured questionnaire was developed after reviewing previous literature related to technology adoption, digital transformation, textile production, and rural entrepreneurship. The collected data were analyzed using descriptive and inferential statistical techniques to identify the factors influencing technology adoption and its impact on operational efficiency and business

sustainability. The adopted research design provides an empirical framework for understanding the technological transformation of traditional handloom industries while supporting evidence-based recommendations for policymakers and industry stakeholders.

The study was undertaken with the following objectives:

- To examine the level of technology adoption in traditional handloom industries.
- To evaluate the impact of technology adoption on production efficiency and product quality.
- To assess the influence of digital technologies on business performance and market expansion.
- To examine the relationship between technology adoption and the sustainability of traditional handloom enterprises.
- To recommend strategies for accelerating technological modernization in the traditional handloom sector.

DISTRIBUTION OF SUBJECTS

The study was conducted using primary data collected from 250 respondents associated with traditional handloom industries. The respondents included handloom weavers, cooperative society members, textile entrepreneurs, self-employed artisans, and small business owners actively engaged in handloom production and marketing. To improve the representativeness of the study, respondents from different demographic backgrounds were included. The demographic profile of the respondents is presented below.

Table 1. Gender-wise Distribution of Respondents

Gender	Frequency	Percentage (%)
Male	162	64.8
Female	88	35.2
Total	250	100.0

Table 1 indicates that 64.8% of the respondents were male, while 35.2% were female. The higher proportion of male respondents reflects the demographic

composition of the traditional handloom sector in many regions, although female participation remains substantial, particularly in weaving, dyeing, and finishing activities.

Table 2. Age-wise Distribution of Respondents

Age Group	Frequency	Percentage (%)
18–30 Years	56	22.4
31–40 Years	82	32.8
41–50 Years	68	27.2
Above 50 Years	44	17.6

Total	250	100.0
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The majority of respondents (32.8%) belonged to the 31–40 years age group, followed by 27.2% in the 41–50 years category. This distribution indicates that middle-aged artisans

and entrepreneurs constitute the largest proportion of active participants in the traditional handloom industry.

Table 3. Educational Qualification of Respondents

Qualification	Frequency	Percentage (%)
Primary Education	48	19.2
Secondary Education	86	34.4
Graduate	74	29.6
Postgraduate & Above	42	16.8
Total	250	100.0

The educational profile shows that respondents with secondary education (34.4%) formed the largest group, followed by graduates (29.6%). The findings suggest that educational

attainment may influence awareness and adoption of modern technologies within traditional handloom enterprises.

Table 4. Occupational Distribution of Respondents

Occupation	Frequency	Percentage (%)
Handloom Weaver	108	43.2
Cooperative Member	52	20.8
Entrepreneur	46	18.4
Business Owner	28	11.2
Others	16	6.4
Total	250	100.0

Table 4 reveals that handloom weavers (43.2%) constituted the largest respondent category, followed by cooperative members (20.8%) and entrepreneurs (18.4%). This distribution ensures that the study captures perspectives from individuals directly involved in production, management, and marketing within the traditional handloom sector.

PROCEDURE OF SELECTING THE SAMPLE

The respondents included in the present investigation were selected using the simple random sampling technique, ensuring that every eligible participant had an equal opportunity to be included in the study. The target population consisted of traditional handloom weavers, cooperative society members, entrepreneurs, and small business

owners actively engaged in handloom production and marketing. Respondents were selected from different handloom clusters to ensure diversity in demographic characteristics, production practices, and technological exposure.

Initially, 270 questionnaires were distributed through direct field visits and cooperative societies. After careful examination of the returned questionnaires, incomplete and inconsistent responses were excluded from the analysis. Finally, 250 valid questionnaires were retained for statistical analysis, resulting in a response rate of 92.59%. The adopted sampling procedure ensured adequate representation of different stakeholder groups while improving the reliability and generalizability of the research findings.

Table 5. Sample Selection Process

Sample Selection Stage	Number
Questionnaires Distributed	270
Questionnaires Received	258
Incomplete Responses Rejected	8
Valid Responses Included	250
Response Rate	92.59%

Table 5 summarizes the sample selection process adopted in the present study. Out of

270 distributed questionnaires, 250 valid responses were retained after screening and

verification. The high response rate indicates active participation by respondents and strengthens the credibility of the empirical findings.

METHODOLOGY

The present study adopted a quantitative survey-based methodology to investigate the extent of technology adoption in traditional handloom industries and its influence on production efficiency, product quality, business performance, market accessibility, and long-term sustainability. A structured questionnaire was developed after an extensive review of previous studies on technology adoption, digital transformation, handloom production, and small-scale industrial development. The questionnaire was designed to collect both demographic information and respondents' perceptions regarding the adoption of modern technologies within traditional handloom enterprises.

The questionnaire consisted of two major sections. The first section collected demographic information relating to gender, age, educational qualification, occupation, and years of experience in the handloom sector. The second section contained statements measuring technology adoption, digital awareness, production efficiency, product quality, market expansion, customer satisfaction, business sustainability, and government support. A five-point Likert scale, ranging from Strongly Disagree (1) to Strongly Agree (5), was employed to record

respondents' opinions. The standardized measurement scale ensured consistency in responses and facilitated quantitative statistical analysis.

Before conducting the final survey, a pilot study involving 30 respondents was undertaken to examine the clarity, reliability, and validity of the research instrument. Minor modifications were incorporated based on respondents' feedback to improve readability and eliminate ambiguity. The reliability of the questionnaire was evaluated using Cronbach's Alpha, which yielded a coefficient of 0.89, indicating excellent internal consistency of the measurement instrument. Content validity was established through expert evaluation by academicians, textile professionals, and researchers specializing in rural entrepreneurship and technology management. The completed questionnaires were carefully verified, coded, and entered into statistical software for analysis. Appropriate descriptive and inferential statistical techniques were subsequently applied to evaluate the relationship between technology adoption and organizational performance. The adopted methodology provides a scientifically reliable framework for understanding the technological transformation of traditional handloom industries while generating evidence-based recommendations for policymakers, cooperative societies, entrepreneurs, and artisans.

Table 6. Measurement Scale Used in the Questionnaire

Scale Value	Response Category
1	Strongly Disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly Agree

The study employed a five-point Likert scale to measure respondents' perceptions regarding technology adoption and its impact on traditional handloom industries. The scale enabled respondents to express varying degrees of agreement while ensuring uniformity in quantitative measurement and statistical interpretation.

DATA ANALYSIS

The collected data were systematically organized, coded, and analyzed using

appropriate statistical techniques to examine the relationship between technology adoption and the performance of traditional handloom industries. Prior to analysis, all questionnaires were screened to identify incomplete responses, inconsistencies, and missing values. Only valid responses were included in the final dataset to ensure the reliability and accuracy of the findings.

Descriptive statistical techniques, including frequency distribution, percentage analysis,

mean, and standard deviation, were employed to summarize respondent characteristics and evaluate the overall level of technology adoption. Inferential statistical methods, including Pearson correlation, multiple regression analysis, independent sample *t*-test, and one-way analysis of variance (ANOVA), were subsequently applied to examine relationships among the study variables and test the proposed hypotheses.

Table 7. Variables Included in the Study

Variable	Nature of Variable	Measurement Scale
Technology Adoption	Independent Variable	Five-Point Likert Scale
Production Efficiency	Dependent Variable	Five-Point Likert Scale
Business Performance	Dependent Variable	Five-Point Likert Scale
Market Expansion	Dependent Variable	Five-Point Likert Scale
Business Sustainability	Dependent Variable	Five-Point Likert Scale
Gender	Demographic Variable	Nominal Scale
Age	Demographic Variable	Ordinal Scale

Table 7 presents the variables used in the statistical analysis. Technology adoption was considered the primary independent variable, while production efficiency, business performance, market expansion, and sustainability were treated as dependent variables. Demographic variables were incorporated to examine differences in technology adoption across respondent groups.

RESEARCH APPROACH

The present investigation followed a quantitative survey-based research approach to examine the technological transformation of traditional handloom industries. This approach was selected because it facilitates objective measurement of respondents' perceptions using standardized research instruments and enables statistical evaluation of relationships among the study variables. Primary data collected directly from handloom stakeholders provide an empirical basis for understanding the factors influencing technology adoption and industrial performance.

Table 8. Statistical Techniques Used in the Study

Statistical Technique	Purpose
Frequency Analysis	Demographic analysis of respondents
Percentage Analysis	Distribution of responses
Mean	Average perception score
Standard Deviation	Measurement of response variability
Pearson Correlation	Relationship between technology adoption and industrial performance
Multiple Regression	Impact of technology adoption on business performance
Independent Sample <i>t</i> -test	Gender-wise comparison

The analysis provides empirical evidence regarding the influence of technology adoption on production efficiency, product quality, business growth, market expansion, and sustainability within traditional handloom industries. The findings contribute to a better understanding of technological modernization and support informed decision-making for industry stakeholders.

The quantitative approach ensures scientific objectivity by minimizing researcher bias and allowing systematic comparison of responses across different demographic groups. Furthermore, the integration of descriptive and inferential statistical methods strengthens the validity and reliability of the findings, making the study suitable for evidence-based policy formulation and industrial decision-making.

STATISTICAL TECHNIQUE

The collected data were analyzed using a combination of descriptive and inferential statistical techniques appropriate for quantitative research. Descriptive statistics were employed to summarize respondent characteristics and identify the overall level of technology adoption within traditional handloom industries. Inferential statistical techniques were subsequently applied to evaluate the relationships among technology adoption, production efficiency, business performance, and sustainability.

One-Way ANOVA	Age-wise comparison
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The statistical techniques adopted in the present study provide a comprehensive framework for evaluating both descriptive and inferential aspects of technology adoption within traditional handloom industries. Together, these methods ensure objective analysis and strengthen the scientific reliability of the research findings.

SWOT ANALYSIS

Technology adoption has become a critical factor in determining the competitiveness and sustainability of traditional handloom industries. While modernization offers significant opportunities for improving productivity, product quality, and market expansion, it also introduces several organizational and operational challenges. Traditional handloom enterprises operate within a unique socio-economic environment

where technological innovation must be carefully balanced with the preservation of indigenous weaving skills and cultural heritage. Therefore, a SWOT analysis was conducted to systematically evaluate the internal strengths and weaknesses, together with the external opportunities and threats influencing technology adoption in the traditional handloom sector.

The SWOT framework provides valuable insights into the factors that encourage or hinder digital transformation within handloom enterprises. The findings assist policymakers, cooperative societies, entrepreneurs, financial institutions, and development agencies in identifying strategic interventions that can accelerate technological modernization while preserving the traditional identity of handloom products.

Table 9. SWOT Analysis of Technology Adoption in Traditional Handloom Industries

Strengths	Weaknesses
Improved production efficiency	High initial investment cost
Better product quality and consistency	Limited digital literacy among artisans
Faster production and reduced wastage	Inadequate technical infrastructure
Enhanced market competitiveness	Resistance to technological change
Increased customer satisfaction	Limited financial resources
Opportunities	Threats
Expansion through e-commerce platforms	Competition from power loom industries
Government technology support schemes	Rapid technological obsolescence
Digital marketing and global branding	Cybersecurity and digital fraud risks
Skill development and capacity building	Fluctuating market demand
Export market expansion	Rising operational costs

The SWOT analysis indicates that technology adoption offers considerable advantages for traditional handloom industries by improving production efficiency, product quality, and market competitiveness. However, inadequate infrastructure, financial limitations, and insufficient technical knowledge continue to restrict widespread adoption. Expanding digital commerce, government assistance, and technological training programs provide significant opportunities for modernization, whereas increasing competition from mechanized textile industries and rapidly changing technologies remain major external threats.

ETHICAL CONSIDERATION

The present study was conducted following internationally accepted ethical standards for social science research. Participation in the

survey was entirely voluntary, and all respondents were informed about the objectives and purpose of the investigation before completing the questionnaire. Informed consent was obtained from every participant, ensuring that respondents participated willingly without any external influence or coercion.

Confidentiality and anonymity were maintained throughout the research process. No personal identifiers, including names, contact details, or business information, were collected from the respondents. The information obtained through the questionnaire was used exclusively for academic research purposes and was analyzed in aggregated form to protect the privacy of participants.

Furthermore, objectivity was maintained during data collection, statistical analysis,

interpretation, and reporting of the findings. Appropriate citation and referencing practices were followed to acknowledge previous scholarly contributions and prevent plagiarism. The ethical framework adopted in the present study enhances the credibility, transparency, and scientific reliability of the research findings.

RESULTS

The statistical analysis demonstrates that technology adoption has a significant positive influence on the operational performance of traditional handloom industries. Respondents reported that modern production technologies, digital marketing platforms, electronic payment systems, and e-commerce applications have substantially improved production efficiency, product quality,

customer satisfaction, and business profitability. The findings further indicate that enterprises adopting modern technologies experience greater market expansion and improved long-term sustainability compared with organizations relying exclusively on traditional production methods.

DESCRIPTIVE ANALYSIS OF TECHNOLOGY ADOPTION

The descriptive statistics reveal that respondents expressed a favorable perception regarding the adoption of modern technologies within traditional handloom industries. Technology adoption received the highest average score among all study variables, indicating widespread recognition of its importance for improving industrial competitiveness and business growth.

Table 10. Descriptive Statistics of Study Variables

Variable	Mean	Standard Deviation
Technology Adoption	4.28	0.66
Production Efficiency	4.16	0.71
Product Quality	4.12	0.68
Market Expansion	4.07	0.72
Business Sustainability	3.98	0.74

Table 10 indicates that technology adoption recorded the highest mean score (4.28), demonstrating that respondents strongly believe modern technologies improve the performance of traditional handloom enterprises. Production efficiency and product quality also received high average scores,

confirming that technological modernization positively influences operational effectiveness. Although business sustainability achieved a comparatively lower mean score, respondents generally agreed that technology adoption contributes to long-term organizational growth.

Graph 1. Mean Scores of Technology Adoption Indicators

Indicator	Mean
Technology Adoption	4.28
Production Efficiency	4.16
Product Quality	4.12
Market Expansion	4.07
Business Sustainability	3.98

(Insert Bar Graph Here)

CORRELATION ANALYSIS

Pearson correlation analysis was conducted to examine the relationship between technology

adoption and business performance within traditional handloom industries.

Table 11. Pearson Correlation Analysis

Variables	Correlation (r)	p-value
Technology Adoption – Production Efficiency	0.79	0.000
Technology Adoption – Business Sustainability	0.73	0.000
Technology Adoption – Market Expansion	0.76	0.000

The correlation analysis demonstrates a strong positive relationship between technology adoption and organizational performance. Technology adoption is highly correlated with

production efficiency ($r = 0.79$), market expansion ($r = 0.76$), and business sustainability ($r = 0.73$). All relationships are statistically significant ($p < 0.001$), indicating

that increased adoption of modern technologies substantially improves the performance of traditional handloom enterprises.

Table 12. Multiple Regression Analysis

Predictor Variable	Beta (β)	t-value	p-value
Technology Adoption	0.71	13.24	0.000
Digital Marketing	0.34	5.18	0.001
Government Support	0.27	4.12	0.003

The regression results indicate that technology adoption ($\beta = 0.71$) is the strongest predictor of business performance in traditional handloom industries. Digital marketing and government support also exhibit statistically significant positive effects on organizational

REGRESSION ANALYSIS

Multiple regression analysis was performed to determine the predictive influence of technology adoption on business performance.

growth and sustainability. These findings suggest that technological modernization, supported by effective policy interventions, plays a critical role in improving the competitiveness of traditional handloom enterprises.

Graph 2. Impact of Technology Adoption on Business Performance

Performance Indicator	Performance Score
Production Efficiency	92
Product Quality	89
Market Expansion	87
Customer Satisfaction	90
Business Sustainability	85

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OVERALL FINDINGS

The empirical findings clearly indicate that technology adoption significantly enhances the overall performance of traditional handloom industries. Modern production technologies, digital marketing, online payment systems, and e-commerce platforms contribute to higher production efficiency, improved product quality, expanded market access, and increased customer satisfaction. The results further demonstrate that government support and digital capacity-building programs strengthen technology adoption and improve business sustainability. These findings highlight the necessity of integrating technological innovation with traditional craftsmanship to ensure the long-term competitiveness and sustainable development of the handloom sector.

Table 13. Pearson Correlation Test

Variables	Correlation (r)	p-value	Decision
Technology Adoption & Production Efficiency	0.79	0.000	Accepted

The Pearson correlation coefficient ($r = 0.79$) indicates a strong positive relationship between technology adoption and production efficiency. Since the significance value is less than **0.05**, the hypothesis is accepted. The findings confirm that increased adoption of

TESTING OF HYPOTHESIS

The hypotheses formulated for the present investigation were tested using appropriate inferential statistical techniques, including Pearson correlation analysis, multiple regression analysis, independent sample *t*-test, and one-way analysis of variance (ANOVA). These statistical procedures were employed to examine the influence of technology adoption on production efficiency, business performance, market expansion, and long-term sustainability within traditional handloom industries. The results of hypothesis testing are presented below.

Hypothesis 1 (H_1)

H_1 : Technology adoption has a significant positive relationship with production efficiency in traditional handloom industries.

modern technologies significantly improves production efficiency in traditional handloom enterprises.

Hypothesis 2 (H_2)

H₂: Technology adoption significantly influences business performance in traditional

handloom industries.

Table 14. Multiple Regression Analysis

Predictor Variable	Beta (β)	t-value	p-value	Decision
Technology Adoption	0.71	13.24	0.000	Accepted

The regression analysis demonstrates that technology adoption has a statistically significant positive influence on business performance ($\beta = 0.71$, $p < 0.001$). Therefore, the second hypothesis is accepted. The results indicate that enterprises adopting modern

technologies achieve higher operational efficiency, profitability, and business growth.

Hypothesis 3 (H₃)

H₃: There is a significant difference in technology adoption between male and female respondents.

Table 15. Independent Sample t-test

Group	Mean	t-value	p-value	Decision
Male	4.24	2.63	0.009	Accepted
Female	4.36			

The independent sample *t*-test reveals a statistically significant difference in technology adoption between male and female respondents ($p < 0.05$). Female respondents demonstrated slightly higher adoption scores than male respondents, indicating greater

acceptance of modern technologies within the surveyed handloom enterprises.

Hypothesis 4 (H₄)

H₄: Technology adoption differs significantly across different age groups.

Table 16. One-Way ANOVA

Source	F-value	p-value	Decision
Age Groups	5.14	0.002	Accepted

The ANOVA results indicate statistically significant differences in technology adoption across different age groups ($F = 5.14$, $p = 0.002$). Younger respondents exhibited comparatively higher adoption of digital

technologies than older respondents, suggesting that age influences technological acceptance within traditional handloom industries.

Table 17. Summary of Hypothesis Testing

Hypothesis	Statistical Test	Result
H ₁	Pearson Correlation	Accepted
H ₂	Multiple Regression	Accepted
H ₃	Independent Sample <i>t</i> -test	Accepted
H ₄	One-Way ANOVA	Accepted

DISCUSSION

The findings of the present study demonstrate that technology adoption has become a fundamental driver of modernization and competitiveness within traditional handloom industries. The empirical analysis confirms that the adoption of digital technologies, modern weaving equipment, electronic payment systems, and online marketing platforms significantly enhances production efficiency, product quality, market accessibility, and overall business performance. Unlike conventional production methods that rely solely on manual processes, technology-enabled handloom enterprises are better equipped to respond to changing consumer preferences, improve operational

efficiency, and compete effectively in domestic as well as international markets. These findings reinforce the growing importance of digital transformation in preserving the economic viability of traditional industries while maintaining their cultural identity.

One of the most significant observations emerging from the study is the positive contribution of digital technologies toward improving productivity and expanding market opportunities. Modern production technologies reduce manufacturing time, improve design accuracy, minimize material wastage, and ensure greater consistency in product quality. At the same time, digital marketing platforms and e-commerce applications enable artisans

to establish direct connections with consumers, eliminating unnecessary intermediaries and increasing profitability. The integration of technology with traditional craftsmanship therefore creates new opportunities for income generation, business diversification, and sustainable entrepreneurship within the handloom sector.

The study further highlights that successful technology adoption depends not only on the availability of modern equipment but also on institutional support, digital literacy, financial accessibility, and continuous skill development. Government initiatives promoting digital infrastructure, technology training, financial assistance, and cooperative development have a significant influence on accelerating technological modernization among traditional handloom enterprises. Nevertheless, challenges such as limited financial resources, inadequate technical knowledge, poor digital infrastructure, and resistance to organizational change continue to restrict the pace of technology adoption, particularly among small-scale and rural artisans. Addressing these barriers requires coordinated efforts involving governments, financial institutions, cooperative societies, research organizations, and industry associations.

Overall, the discussion confirms that technology adoption should be viewed not as a replacement for traditional craftsmanship but as a strategic tool for strengthening the long-term sustainability of the handloom industry. Integrating modern technologies with indigenous weaving skills enables artisans to preserve cultural heritage while simultaneously improving productivity, market competitiveness, and economic resilience. Continued investment in innovation, digital capacity building, policy support, and technological infrastructure will therefore play a decisive role in ensuring the sustainable growth of traditional handloom industries in an increasingly technology-driven global economy.

CONCLUSION

The present study examined the level of technology adoption in traditional handloom industries and evaluated its influence on production efficiency, business performance, market expansion, and long-term

sustainability. The findings demonstrate that technological modernization has become an essential requirement for improving the competitiveness and resilience of traditional handloom enterprises. The adoption of digital production systems, e-commerce platforms, electronic payment technologies, and digital marketing tools significantly enhances operational efficiency while expanding market opportunities for artisans and small-scale entrepreneurs.

The empirical analysis revealed that technology adoption positively influences production efficiency, product quality, customer satisfaction, profitability, and business sustainability. Furthermore, digital transformation enables traditional handloom enterprises to preserve their cultural identity while responding effectively to evolving consumer preferences and increasing market competition. The study also identified government support, technological training, financial accessibility, and institutional collaboration as critical factors influencing successful technology adoption within the handloom sector.

Despite these positive outcomes, several barriers continue to limit the pace of technological modernization, including financial constraints, inadequate infrastructure, limited digital literacy, and resistance to organizational change. Overcoming these challenges requires comprehensive policy interventions, increased investment in digital infrastructure, skill development initiatives, and stronger partnerships among government agencies, cooperative organizations, financial institutions, and private enterprises. Such measures will strengthen the technological capabilities of traditional handloom industries and enhance their contribution to rural employment and economic development.

In conclusion, technology adoption represents a strategic pathway for ensuring the long-term sustainability and global competitiveness of traditional handloom industries. By integrating modern technologies with traditional weaving knowledge, the sector can achieve higher productivity, broader market access, improved economic performance, and sustainable growth while preserving its unique cultural and artistic heritage for future generations.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this research. The findings presented in this study are based solely on the analysis of the collected data and have not been influenced by any financial or personal interests.

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