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Cyber Threat Exposure and Institutional Support for Women Entrepreneurs in E-Commerce: A Study of Delhi and Faridabad

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Abstract

This study investigates the cybersecurity challenges faced by women entrepreneurs operating e-commerce businesses in two distinct urban centres of North India—Delhi and Faridabad. As digital platforms increasingly become vital tools for economic empowerment, women-led ventures remain disproportionately vulnerable to cyber threats due to limited access to technical knowledge, institutional support, and affordable cybersecurity infrastructure. Utilizing a quantitative, questionnaire-based research design, this study surveyed 300 women entrepreneurs (150 from each city) to examine the prevalence of cybersecurity threats, the effectiveness of institutional support mechanisms such as District Industries Centres (DIC), and the barriers to implementing digital safeguards. Descriptive and inferential statistical analyses, including Chi-square tests, revealed that while awareness of cybersecurity issues is relatively high (over 70%), actual threat exposure—including phishing, malware, and account breaches—is widespread, affecting 66% of respondents. Moreover, institutional schemes like DIC are underutilized due to low awareness and administrative complexity. Key implementation barriers included high costs (36%), time/resource constraints (31%), and technical skill gaps (15.3%). Significant regional differences were observed, affirming the role of urban infrastructure and institutional accessibility in shaping cybersecurity resilience. The study concludes that while digital platforms offer transformative potential for women entrepreneurs, this potential remains undermined by cybersecurity vulnerabilities. It calls for targeted, gender-sensitive interventions including financial subsidies, expert-led capacity-building programs, and streamlined institutional outreach to support safe and inclusive participation in India's growing digital economy.

Introduction

In the age of digital transformation, e-commerce has emerged as a powerful tool of economic empowerment for women entrepreneurs in India, offering flexibility, autonomy, and access to wider markets. However, this progress is increasingly undercut by growing cybersecurity threats—such as phishing, data breaches, account takeovers, and malware—that disproportionately affect women-led businesses. These challenges are further compounded by low levels of technical literacy, limited awareness of threat mitigation strategies, and inadequate access to institutional support systems. This study offers a comparative analysis of 300 women entrepreneurs in Delhi and Faridabad, two urban centers representing different stages of digital and infrastructural development. While

Delhi benefits from relatively mature digital infrastructure and support mechanisms, Faridabad presents a digitally transitional landscape with persistent gaps in policy implementation and institutional accessibility. The research investigates the types and severity of cybersecurity threats encountered, assesses the awareness and utilization of support schemes like those offered by District Industries Centres (DIC), and identifies barriers—such as cost, time constraints, and lack of expertise—that hinder the adoption of protective measures. Using a structured questionnaire and supported by statistical tools like Chi-square tests, the study validates four hypotheses concerning operational impact, regional variation, resource constraints, and reputational damage. The findings underscore the need for gender-sensitive, region-specific cybersecurity interventions and policy reforms that promote digital safety, institutional trust, and sustainable e-commerce participation. This research contributes to the limited but growing literature on women's digital vulnerability in India and aligns with national and global agendas such as the Digital India initiative and UN Sustainable Development Goals (SDG 5 and SDG 8).

Literature Review

In the evolving landscape of digital entrepreneurship, the intersection of gender, technology, and security has emerged as a critical research domain. With the rapid proliferation of e-commerce in India, women entrepreneurs have increasingly leveraged digital platforms to transcend conventional socio-economic constraints. However, this digital empowerment is accompanied by escalating exposure to cyber threats. As highlighted by Chakraborty et al. (2022), in a study published in the Information Resources Management Journal, the design, security, and user experience of e-commerce platforms significantly influence customer trust and loyalty. Inadequate website security increases susceptibility to phishing, malware, and financial fraud, especially among small-scale entrepreneurs with limited technological resources. The role of trust and institutional transparency in cybersecurity is further emphasized in a Scopus-indexed study by Oliveira et al. (2017), which highlights how organizational trust frameworks and compliance with data protection regulations influence adoption of cybersecurity best practices among SMEs. This insight aligns with findings from Madnani (2024), who evaluated the reliability of AI systems in managing sensitive data, emphasizing that user confidence hinges on data protection, transparency, and accountability—elements frequently underdeveloped in small enterprises. Moreover, Kaur (2021), in her Routledge-edited volume on women's entrepreneurship in India, illustrates the transformative impact of digital tools in promoting gender-inclusive business environments. Complementing this, a study by Dwivedi et al. (2021), published in Government Information Quarterly, establishes that female-led enterprises often lag behind in cybersecurity preparedness due to socio-cultural constraints, insufficient policy access, and lower digital literacy, especially in semi-urban and tier-2 cities. Regional disparities further complicate the digital inclusion of women entrepreneurs. Arora (2021) observes that while Delhi exhibits high digital maturity with advanced IT infrastructure, regions like Faridabad, though rapidly industrializing, still grapple with inconsistent connectivity and lower digital literacy rates. Bishnoi and Mittal (2017) similarly noted that consumer trust and security concerns vary by region, indicating that entrepreneurs in transitional urban markets face greater reputational risks. The institutional dimension has been addressed by Rasheed et al. (2011), whose CRISP working paper examined ICT-based empowerment models for women. Their research underscores the importance of sustained capacity-building, embedded institutional support, and localized digital training—elements crucial for cybersecurity adoption in women-led ventures. In alignment, Alshamrani et al. (2020), writing in Computers & Security (Elsevier), emphasize that small businesses are highly vulnerable to cyberattacks unless systematically supported by structured cybersecurity governance and risk-assessment mechanisms. Furthermore, a comparative analysis by Shin and Kang (2020) in Telecommunications Policy finds that gender-sensitive cybersecurity policies, when combined with business mentoring and financial support, significantly increase the resilience of women-owned digital enterprises in emerging economies. This underscores the importance of integrating consumer trust-building and institutional safeguards into cybersecurity frameworks.

Taken together, the literature converges on the understanding that while e-commerce presents transformative opportunities for women entrepreneurs, it also introduces complex challenges—particularly in terms of digital security, institutional support, and regional disparities in digital readiness. There remains a pressing need for primary, data-driven research that examines the real-world cybersecurity practices, awareness levels, and institutional

engagement of women-led businesses across distinct urban contexts such as Delhi and Faridabad.

Research Methodology

Research Design

The purpose of this quantitative, questionnaire-based empirical study with a descriptive-comparative orientation is to systematically assess the cybersecurity challenges, awareness levels, institutional support mechanisms, and business impacts experienced by women entrepreneurs engaged in e-commerce in Delhi and Faridabad. The main tool for collecting primary data was a structured questionnaire.

Population and Sampling Framework

Women entrepreneurs who were actively running e-commerce companies in the cities of Delhi and Faridabad made up the study's demographic. A stratified random sampling technique was used to guarantee equitable representation from both areas and across various business types (product-based, service-based, and hybrid), given the comparative nature of the study. A regionally balanced and statistically robust foundation for comparative analysis was provided by the 300 valid replies that were collected, 150 from each area. Digital company registries, women entrepreneur networks, and business listings were used to create sampling frames.

Questionnaire Design and Data Collection

A standardized, pre-tested questionnaire that was carefully crafted to gather factual and perceptual insights from female entrepreneurs across many cybersecurity-related aspects was used to gather primary data. Awareness and comprehension of cybersecurity threats, direct experience with specific cyber incidents (e.g., phishing, data breaches, identity theft, malware, hacking), and the degree of familiarity with institutional support mechanisms, particularly those provided by the District Industries Centers (DIC), were among the major themes covered by the questionnaire. It also looked at the participants' expectations for institutional or governmental support, the difficulties of putting cybersecurity measures in place, and the projected business impact of such risks. To enable consistent responses and guarantee compatibility with statistical analysis, the questionnaire was made up of closed-ended, multiple-choice, and matrix-type items. To increase outreach, it was distributed through printed copies as well as digital media. Reliability and clarity were evaluated using a pilot test with 20 participants, after which small changes were made to improve content validity.

Data Analysis Techniques

IBM SPSS Statistics (Version 26) was used to systematically code and analyze the acquired data in order to extract statistically significant insights from the questionnaire replies. Descriptive and inferential analysis were the two stages of the analytical process. Using frequencies, percentages, and cross-tabulations, descriptive statistics were used to summarize demographic profiles and broad trends. These provided a summary of cybersecurity awareness levels, perceived threat experiences, age distribution, and business type. The associations between categorical variables—such as geography and threat awareness, experience of particular cybersecurity incidents, and availability to institutional assistance such DIC schemes—were examined using Chi-square tests of independence for inferential analysis. Furthermore, the robustness of the Chi-square results was supported by Likelihood Ratio statistics, particularly in situations with low predicted frequencies. Additionally, Cramér's V was used to assess the degree of correlation between the variables. A standard significance level of $p < 0.05$ was used for all statistical conclusions, guaranteeing the validity of observed trends throughout the sample.

Data Analysis and Interpretation

Demographic Profile of Respondents:

This table shows the age distribution of the 300 female entrepreneurs who took part in the study, with equal representation from Delhi and Faridabad (150 each). The majority of respondents (29%) were under the age of 25, followed by those aged 46-55 (28%), 26-35 (22%), and 36-45 (17.7%). The smallest share (3.3%) came from those aged 56 and up. This distribution represents a varied range of generational viewpoints on the digital business landscape.

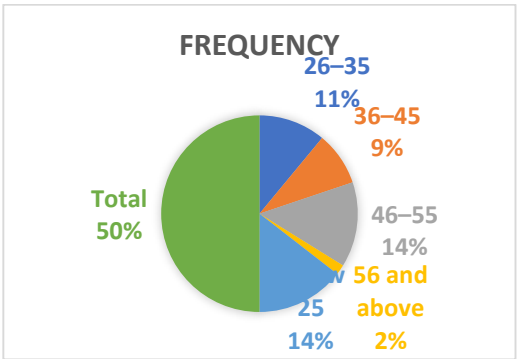


Figure 1. Age-wise distribution of women e-commerce entrepreneurs (N = 300)

Figure 1 depicts the age distribution of respondents, emphasizing the generational diversity in the sample of 300 women e-commerce entrepreneurs from Delhi and Faridabad. The pie chart depicts each age group's proportional contribution, which helps to contextualize disparities in technological exposure, cybersecurity knowledge, and reaction behavior across generations.

The highest proportion of respondents are under the age of 25 (29%), followed by those aged 46 to 55 (28%). Respondents aged 26 to 35 account for 22%, while 17.7% are between the ages of 36 and 45. The 56 and older age group makes up the smallest proportion of the sample, accounting for 3.3%. Overall, the distribution represents a wide generational mix, demonstrating participation by both young and experienced

Location wise Distribution of Respondents

Table 1 illustrates the location-specific distribution of responders, demonstrating an equal representation from Delhi and Faridabad. This geographic balance was chosen purposefully to offer a fair and regionally compared analysis of cybersecurity awareness and experiences among urban female entrepreneurs

Table 1: Geographic Distribution of Respondents by Location

Location	Frequency	Percent	Valid Percent	Cumulative Percent
Delhi	150	50.00 %	50.00 %	50.00%
Faridabad	150	50.00 %	50.00 %	100.00 %
Total	300	100 %	100 %	100%

The table shows a 50-50 split between the two districts, allowing the researchers to investigate cybersecurity patterns in two distinct yet economically significant metropolitan areas. This distribution boosts the comparative integrity of the study and increases the validity of regional inferences.

Type of E-commerce Business

Table 2 shows the distribution of female e-commerce entrepreneurs based on the nature of their firms. According to the research, the majority (44%) own and operate service-based businesses such as consulting, wellness, or beauty services. A sizable proportion (30.3%) manage mixed models that include both items and services, while 25.7% work in product-centric firms such as fashion or home décor.

Table 2: Distribution of Respondents by Type of E-commerce Business

Type of E-commerce Business	Frequency	Percent	Valid Percent	Cumulative Percent
Mixed (Both Products & Services)	91	30.30%	30.30%	30.30%
Product-Based (e.g., Fashion, Home Décor)	77	25.70%	25.70%	56.00%
Service-Based (e.g., Consulting, Beauty Services)	132	44.00%	44.00%	100.00%
Total	300	100%	100%	100%

This distribution highlights women's considerable engagement in service-oriented sectors, which is most likely owing to cheaper capital requirements, the convenience of online delivery, and a better fit with home-based entrepreneurship. The existence of mixed models also suggests a shift toward more diverse online offerings to improve corporate sustainability. Same Figure 3 depicts the distribution of e-commerce business models used by female entrepreneurs participating in the survey. The visual representation reveals the prevailing business orientations—service, product, or mixed—and lays the groundwork for investigating their relationship to cybersecurity preparation and digital operational behaviour.

Table 3 shows a comparative age-wise analysis of women entrepreneurs in Delhi and Faridabad who work in ecommerce. Understanding the demographic composition of respondents helps examine generational trends in digital entrepreneurship, including how age may influence cybersecurity awareness, digital adaptability, and institutional engagement.

Table 3: Comparative Age-wise Distribution of Respondents by Location

Location		Frequency	Percent	Valid Percent	Cumulative Percent
Delhi	26-35	31	20.7	20.7	20.7
	36 - 45	22	14.7	14.7	35.3
	46 - 55	42	28	28	63.3
	56 and above	10	6.7	6.7	70
	Below 25	45	30	30	100
	Total	**150**	**100**	**100**	
Faridabad	26-35	35	23.3	23.3	23.3
	36 - 45	31	20.7	20.7	44
	46 - 55	42	28	28	72
	Below 25	42	28	28	100
	Total	**150**	**100**	**100**	

In Delhi, the greatest age group for entrepreneurs is "Below 25" (30%), followed by individuals aged 46-55 (28%), and 26-35 (20.7%). A significant proportion (6.7%) of respondents were 56 and older, reflecting a slightly greater age distribution in the capital. In Faridabad, the age distribution is similar, except there is no representation in the 56+ category. The largest category was a tie between "Below 25" (28%) and "46-55" (28%), followed closely by 26-35 (23.3%) and 36-45 (20.7%). These findings indicate that, while younger entrepreneurs (under 35) make up a sizable share of the digital business environment in both cities, Delhi exhibits greater diversity at the upper age groups. This generational distribution can have an impact on risk perception, technological proficiency, and the nature of cybersecurity readiness across areas.

Table 4 shows the classification of e-commerce business models used by women entrepreneurs in two regions: Delhi and Faridabad. It provides comparative insight into the types of initiatives that are most popular in each metropolitan setting—mixed, product-based, or service-based.

Table 4: Comparative Distribution of E-commerce Business Types by Location

Location		Frequency	Percent	Valid Percent	Cumulative Percent
Delhi	Mixed (Both Products & Services)	42	28	28	28
	Product-Based (e.g., Fashion, Home Décor)	39	26	26	54
	Service-Based (e.g., Consulting, Beauty Services)	69	46	46	100
	Total	**150**	**100**	**100**	
Faridabad	Mixed (Both Products & Services)	49	32.7	32.7	32.7

	Product-Based (e.g., Fashion, Home Décor)	38	25.3	25.3	58
	Service-Based (e.g., Consulting, Beauty Services)	63	42	42	100
	Total	**150**	**100**	**100**	

In Delhi, service-based firms account for 46%, followed by mixed businesses (28%), and product-based models (26%). Similarly, Faridabad has a strong preference for service-based businesses (42%), with a slightly greater proportion of mixed enterprises (32.7%). Product-based businesses are roughly identical in both cities (26% in Delhi, 25.3% in Faridabad). The constancy of service-led models demonstrates a preference for low-capital, flexible firms, whereas the emergence of mixed businesses, particularly in Faridabad, indicates a growing trend of diversification in urban e-commerce.

Awareness and Experience of Cybersecurity Threats

Among the 300 respondents, the vast majority (70.3%) indicated being aware of prevalent cybersecurity concerns. According to a crosstab study, Delhi respondents had slightly higher knowledge (70.7%) than Faridabad respondents (69.3%).

When asked about firsthand experience with threats

- The most common responses were phishing, malware/ransomware, and account takeover.
- Chi-square analysis found significant differences in threat types and frequency across both cities (Delhi: χ^2 = 28.294, p =.000; Faridabad: χ^2 = 26.743, p =.000), showing regional diversity in exposure patterns.

Table 5 examines the association between cybersecurity awareness and actual experience with major cyber dangers among female businesses in Delhi and Faridabad. Phishing, malware/ransomware, identity theft, account takeovers, and data breaches are among the dangers under consideration. The table aids in determining whether awareness levels correlate with a decrease in threat exposure or vary greatly by region.

Count								
Location			**Which of the following cybersecurity threats have you experienced in your e-commerce business?**					**Total**
			Data Breaches	**Hacking /Account Takeover**	**Identity Theft**	**Malware/ Ransomware**	**Phishing**	
Delhi	**Are you aware of the common cybersecurity threats faced by e-commerce businesses?**	**No**	5	24	0	15	0	44
		Yes	23	22	21	27	13	106
	Total		28	46	21	42	13	150
Faridabad	**Are you aware of the common cybersecurity threats faced by e-commerce businesses?**	**No**	6	22	0	17	0	45
		Yes	29	19	18	29	10	105
	Total		**35**	**41**	**18**	**46**	**10**	**150**

Respondents who reported being oblivious of cybersecurity concerns in both Delhi and Faridabad experienced major events, including 24 cases of hacking/account takeover in Delhi and 22 in Faridabad, as well as a large number of malware/ransomware cases. This demonstrates

that a lack of understanding does not protect entrepreneurs against threat exposure. Among those who were aware, high threat reports were still prevalent. For example, in Delhi, 27 malware/ransomware, 23 data breaches, and 21 identity theft cases were reported by informed participants. Faridabad followed a similar pattern, with 29 malware/ransomware, 29 data breaches, and 18 identity theft cases within the aware group. These findings imply that awareness alone may not be enough to protect against cyber risks, particularly if technical understanding and prevention techniques are missing.

The high frequency of attacks among both aware and uninformed groups need increased institutional support and practical cybersecurity training customized to women-led e-commerce firms.

Table 6 shows the results of Chi-square statistical tests used to determine whether there is a meaningful relationship between women entrepreneurs' cybersecurity awareness and their real experience with cyber risks. The study is done individually for Delhi and Faridabad, utilizing Pearson's Chi-square and Likelihood Ratio methods on 150 valid cases from each area.

Table 7: Chi-Square Test Results for Association Between Cybersecurity Awareness and Threat Experience by Location

Chi-Square Tests				
Location		**Value**	**df**	**Asymptotic Significance (2-sided)**
Delhi	**Pearson Chi-Square**	28.294[a]	4	0
	Likelihood Ratio	36.826	4	0
	N of Valid Cases	150		
Faridabad	**Pearson Chi-Square**	26.743[b]	4	0
	Likelihood Ratio	33.968	4	0
	N of Valid Cases	150		

The results for both locations indicate highly significant associations. In Delhi, the Pearson Chi-square value is 28.294 with a p-value of .000, and the Likelihood Ratio is 36.826—also significant at the 0.01 level. Similarly, Faridabad's Pearson Chi-square is 26.743, and its Likelihood Ratio is 33.968, both with p-values of .000. These results confirm that there is a statistically significant relationship between being aware of cybersecurity threats and experiencing them. However, the significance in both locations does not necessarily imply that awareness prevents threat exposure; rather, it may reflect that more aware respondents are better able to identify and report such threats. The note on expected cell counts ("10% of cells had expected counts < 5") is within acceptable limits, suggesting the results are robust and reliable. These findings validate the hypothesis that cybersecurity awareness levels are significantly associated with threat experience patterns, and they reinforce the need for not only awareness but also practical training and institutional intervention. These findings support the notion that cybersecurity awareness levels are highly associated with threat experience patterns, and they emphasize the importance of not only awareness, but also practical training and institutional intervention.

Challenges of Implementing Cybersecurity Measures

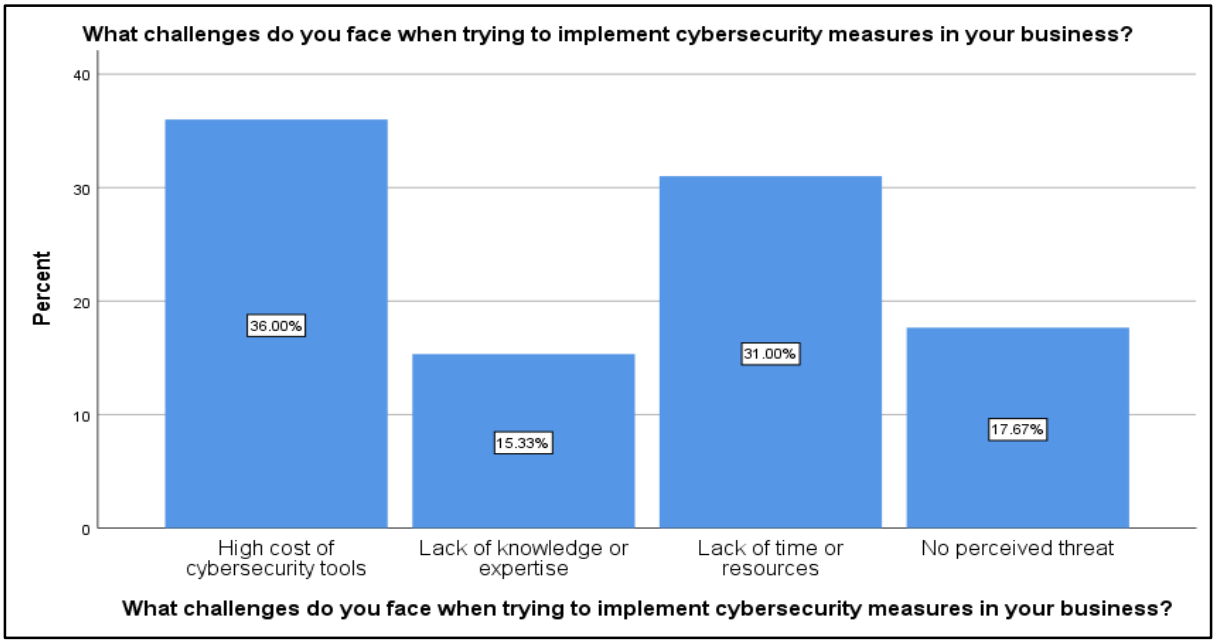
In addition to determining the scope and effect of cybersecurity risks, the study looked into the primary challenges that women entrepreneurs experience when seeking to apply defensive measures. Cybersecurity preparation is more than just awareness; it also requires access to financial, technological, and human resources. Respondents were asked to identify the most important difficulties they faced when trying to safeguard their e-commerce business. The replies demonstrate pervasive structural and resource-based impediments, many of which persist even after past exposure to cyber risks. This section examines these barriers on an aggregate basis as well as in terms of geographical and experiential variances.

Table 8: Frequency Distribution of Cybersecurity Implementation Challenges

Challenge Type	Frequency	Percent	Valid Percent	Cumulative Percent
High Cost of Cybersecurity Tools	108	36.00%	36.00%	36.00%
Lack of Knowledge or Expertise	46	15.30%	15.30%	51.30%
Lack of Time or Resources	93	31.00%	31.00%	82.30%
No Perceived Threat	53	17.70%	17.70%	100.00%
Total	**300**	**100%**	**100%**	**100%**

Table 8 summarizes the problems that women e-commerce entrepreneurs encounter while implementing cybersecurity protections. The most commonly mentioned barrier was the high cost of cybersecurity products (36%), closely followed by a lack of time or resources (31%). A remarkable 17.7% stated that they did not see cybersecurity as a necessary concern, while 15.3% cited a lack of technical understanding or skills. These findings highlight the practical challenges that women entrepreneurs experience in implementing cybersecurity precautions, even when they are aware of the risks. To increase the adoption of digital safety practices, regulatory reforms, financial aid, and capacity-building programs must address cost, time, and skill constraints.

Figure 2 demonstrates the key challenges experienced by female entrepreneurs when implementing cybersecurity measures in their e-commerce operations. The most frequently stated hurdle is the high cost of cybersecurity tools, which 36% of respondents indicate. This is closely followed by a lack of time or resources (31%), demonstrating the operational burden that small businesses frequently experience when balancing business expansion with digital security measures. A significant 17.67% of individuals reported no perceived threat, indicating a psychological or knowledge gap in recognizing cyber hazards. The least stated difficulty was a lack of knowledge or competence, at 15.33%, although it remains a significant barrier. The figure demonstrates that resource constraints—both financial and logistical—are the biggest deterrents, stressing the importance of targeted capacity-building and subsidized cybersecurity assistance programs.



Interpretation and Summary of Statistical Results

The study found that simply being aware does not guarantee good protection.

- Cybersecurity dangers vary regionally.
- Institutional schemes, such as DIC, are underutilized and inconsistently used.
- Cost and lack of understanding are significant

barriers.
Statistically significant Chi-square values for awareness, impact, and institutional engagement support Hypotheses H1, H2, H3, and H4 confirm that cyber threats impact operational efficiency (H1).
- Exposure levels differ greatly by area (H2).
- Limited resources restrict mitigation efforts (H3).
- Threats impact business reputation and trust. (H4)

Conclusion and Future Directions

Conclusion

This study offers an empirically informed, region-specific examination of the cybersecurity landscape among women-led e-commerce enterprises in Delhi and Faridabad. Based on replies from 300 entrepreneurs, the study demonstrated that cybersecurity threats not only exist but also have a major impact on these companies' operational resilience, digital confidence, and reputational stability. This study's gendered focus highlights the specific problems that women entrepreneurs confront, such as inadequate technological literacy, institutional inaccessibility, and chronic digital insecurity. The study also reveals that institutional mechanisms like as DIC are underutilized, owing to a lack of awareness and process inefficiencies. Even when awareness exists, it does not always result in the proactive application of cybersecurity precautions. Furthermore, problems such as high tool costs, time/resource restrictions, and a perception of low threat remain formidable barriers. The study confirms all four assumptions with strong statistical validation and emphasizes the critical necessity for targeted, regionally tailored interventions. These should extend beyond general digital.

Future Research Directions

Building on the current findings, future research should use broader comparative frameworks that include rural women entrepreneurs and participants from other rising Indian cities to gain a better understanding of regional differences in digital access and cybersecurity resilience. Longitudinal studies should be conducted to assess the long-term impact of institutional interventions, such as District Industries Centre (DIC) activities, in raising awareness and promoting the use of protective measures. Furthermore, qualitative research approaches such as case studies and narrative interviews could supplement this survey-based approach by highlighting the lived realities, obstacles, and adaptation strategies of female entrepreneurs in the digital sector. Future research should also look into the active role of private-sector entities, such as e-commerce platforms, fintech companies, and cybersecurity service providers, in co-creating inexpensive, scalable, and gender-responsive security solutions for small and medium businesses.

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