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The Integration of Supply Chain Management, Competitive Advantages, and Enterprise Resource Planning: Insights from Women-Owned Enterprises in Bangladesh

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Abstract

The purpose of this research is to investigate how Supply Chain Management (SCM) practices affect women-owned businesses' competitiveness in Bangladesh. For this reason, Enterprise Resource Planning (ERP) has been used to moderate SCM techniques and Competitive Advantage (CA). Surveys were done on 233 small and medium-sized businesses in five functional areas: Customer Relationship Management (CRM), Supplier Relationship Management (SRM), Supply Chain Innovation (SCI), Strategic Supplier Partnership (SSP), and Internal Lean Practice (ILP). Moderator analysis included Enterprise Resource Planning (ERP). Only enterprises with fewer than 300 workers in the subsectors of Agro-processing, Fashion items, Healthcare, Educational services, and Pharmaceuticals were sampled. The outcome of factor analysis suggests that enterprise resource planning, supplier relationship management, customer relationship management, and strategic supplier partnership were the main supply chain management strategies that affected women-owned SMEs' competitive advantage, while Enterprise Resource Planning moderated SCM methods' favorable effects on Competitive Advantage. The originality of the research lies in integrating these three key dimensions for women-owned SMEs, an underprivileged segment. The implication of this study emphasizes the awareness of an efficient SCM plan for the better landscape of women-owned enterprises, similar to large businesses.

Keywords: Supply Chain Management, Competitive Advantages, Women Enterprises, Enterprise Resource Planning, SMEs.

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Introduction

Globalization has shown organizations how important a good supply chain is to local and global competitiveness. Companies must maintain many competitive advantages to prosper. Logistics and supply chain management may assist in such circumstances (Jamaludin et al., 2021, 2022). Darmawan et al. (2021) define competitive advantage as an organization that has potential that exceeds other organizations and cannot be simply copied because there is a special strategy formulation that makes it unique. According to Day et al. (1988), competitive advantage helps firms survive. Supply Chain Management connects suppliers, manufacturers, and customers to save money and gratify customers (Jamaludin et al., 2022). Today, developing nations like Bangladesh struggle to strengthen SCM to compete in modern business. In the 1990s, competition and globalization made it tougher to provide goods and services on time and economically. Companies require competitive supply networks and internal efficiency. Companies must grasp supply chain management to thrive worldwide (Childhouse et al., 2003; Moberg et al., 2002; Power et al., 2001; Tan et al., 2002). With this context in mind, the purpose of this research is to identify the link between effective supply chain management and a company's ability to gain a competitive edge. As digital innovation, company models, strategy, B2B e-commerce adoption, and economic and competitive analysis affect competition (Hidayat et al., 2022), this study is pioneering by taking women-owned SMEs into account. Historically, supply chain competency impacts women-owned SMEs' competitiveness, technological adaptability, open innovation (Meng et al., 2021), e-literacy-adoption model (Omiunu, 2019), and performance (Puspita et al., 2020). This research pioneers supply chain management and women-owned SMEs' competitiveness as a significant addition to the discipline from the perspective of Bangladesh.

As Bangladesh adopts global SCM and performance-based competition, Bangladeshi companies' SCM successes and failures are well-researched (Uddin et al., 2019). COVID-19 (Dhar et al., 2022), political turmoil, common in developing countries (Jaim, 2022), and financial accessibility and knowledge have been studied on Bangladeshi women-owned SMEs' growth. Female entrepreneurship growth (Mohsin, 2019), work opportunities for women in Bangladesh's SME sector (Akter, 2020), and gender's impact on women's entrepreneurial decisions in a patriarchal developing country were studied (Jaim, 2021). Supply chain management and competitive advantage are seldom studied. Thus, this study is crucial to assist women SMEs to compete by improving the ground of supply chain management on new dynamics of factors.

2. Literature Review

To discover the relevance of customer relationship management, a significant study with customer satisfaction serving as a mediator indicates that customer relationship management and corporate reputation significantly and positively influence customer loyalty (Khan et al., 2022). The impact of electronic customer relationship management on service quality in private hospitals in Jordan has been investigated, signifying that it enhanced service quality significantly (Alshurideh, 2022). R. S. Maraj investigated the impact of customer orientation, CRM organization, knowledge management, and CRM-based technology on customer satisfaction within the hotel business in Kashmir, showing customer satisfaction favorably correlating with CRM attributes (Sofi et. al., 2020). A study on 779 Indian public and private banks shows CRM improves loyalty via customer knowledge management, satisfaction, and trust (Gopalsamy et. al., 2021). Another study, using CRM as a

mediating variable on e-commerce consumers in Malaysia, indicates that CRM had no substantial mediating effect (Dastane, 2020).

In the context of supply relationship management, a significant study in the dynamic context of Bangladesh revealed that collaboration with suppliers and enduring supplier relationships were seen to significantly and positively influence the cost efficiency of supply chains in Bangladeshi enterprises (Emon et. al., 2024). Another dynamic study examining how top management commitment (TMC) mediates the connection between external constraints and supplier relationship management (SRM) practices in the context of the circular economy (CE) demonstrates that TMC positively affects the effect of external institutional pressures on SRM (Dubey et. al., 2019). A full SRM system framework was suggested by examining extensive methodologies for overall SRM functions because the proposed framework might enhance SRM efficiency and effectiveness via an integrated approach (Park et. al., 2010). The impact of key supplier relationship management (KSRM) on SCM performance demonstrated that external supply chain management resources influence key supply relationship management competencies (Teller et. al., 2016). In a similar context, a research framework based on a cross-functional, cross-firm SRM approach is suggested to be used for managing business-to-business relationships to co-create value and enhance shareholder value (Lambert et. al, 2012).

In the case of supply chain innovation (SCI), the influence of big data analytics is investigated, and results corroborate the basic premise that agility and flexibility mediate the relationship between BAC and big data innovation in supply chains (Bhatti et al., 2024). A further study on the mediating role of SCI in the link between Digital Supply Chain (DSC) and Supply Chain (SC) dynamic capacities demonstrated that DSC significantly enhances both (Li et. al. 2024). To foster resilient food supply systems, 'Business strategy innovations' also appeared as the most beneficial in improving food supply chain resilience, followed by 'Technological innovations' (Joshi et al., 2023). A study on the influence of absorptive capacity (ACAP) on SCI with mediation by digital capability, resilience, agility, and digital innovation demonstrated that ACAP significantly and positively influences DCAP, SCA, and SCR (Abourokbah et al., 2023). A framework for supply chain innovation grounded on three ambidextrous capabilities: purpose, span, and direction.is also illustrated to increase their competencies in SCI (Solaimani et al., 2022).

As far as strategic supplier partnership (SSP) is concerned, no recent research has particularly investigated it rather as an element of supply chain management. Consequently, a significant study revealed that sharing postponement, information quality, and strategic supplier partnerships enhance organizational performance while Supply Chain Complexity acts as a moderator (Al-Rawashdeh et al., 2023). The similar correlation between SCM methods and organizational performance, along with the moderating effect of management style has been examined demonstrating that Information Quality (IQ) improves Organizational Performance (OP), with Strategic Supplier Partnerships (SSP) playing a crucial role and management type moderating the influence of Strategic Supplier Partnerships (SSP), Information Quality (IQ), Customer Relationship (CR), and Postponement (POS) on Organizational Performance (Jawabreh et al., 2023).

A recent study on the moderating role of Big Data Analytics (BDA) on the relationship between supply chain management practices (SCMPs) and competitive advantage (CA) across Jordanian manufacturing firms indicates that SCMPs substantially enhance CA, with Information quality (IQ) and information

sharing (ISh) having favorable impacts on competitive advantage (Baqleh, 2023). A separate study investigated the impact of supply chain strategies on environmental sustainability and financial performance and revealed that supply chain practices, including customer interactions, postponements, information exchange, and information quality, significantly influence environmental sustainability, leading to financial prosperity. Ultimately, environmental sustainability mediated the relationship between the two except SSP (Jum'a et al., 2021). Another notable study within the Malaysian manufacturing industry showed SSP significantly correlates with product quality and corporate performance (Agus et al., 2008).

Another substantial variable of this research- training and development has been examined in the relationship between organizational success, internal lean practices, and supplier engagement, and identified a positive correlation between supplier involvement and organizational success, along with internal lean methodologies (Kuncorojati et al., 2024). In a separate study, R. Chavez investigated the potential of Industry 4.0 digital technologies to enhance the influence of lean manufacturing on social performance (Chavez et al., 2024). A study by M. Al-Dweiri investigated the impact of supply chain integration on operational performance in Jordanian manufacturing firms and concluded that the integration of the supply chain, both internally and externally, might enhance operational performance (Al-Dweiri et. al., 2024). Separate research by V. V. Muthuswamy investigated the impact of internal lean practices (ILP), green operations practices (GOP), and enterprise resource planning (ERP) on operational performance (OP) inside Saudi Arabian manufacturing firms, highlighting supply chain integration (SCI) as a mediating variable. The research indicated that ILP, GOP, and ERP significantly improved both SCI and OP (Muthuswamy et al., 2023). L. Gutierrez et al.conceptualized and tested lean operations, supply chain management and demonstrated that lean operations and supply chain methods facilitated the development of DC micro foundations (Gutierrez et al., 2022).

S. Mohammadi et al. examined the impact of ERPS implementation on organizational performance indicating that ERPS influences corporate performance and correlates with modifications in management practices and control systems (Mohammadi et al., 2025). J. K. Buor et al. executed the influence of ERP system integration on productivity within small to medium-sized pharmaceutical enterprises and emphasized the significance of ERP systems in enhancing communication and collaboration within organizational divisions (Buor et al., 2024). Critical Success Factors (CSF) of ERP implementation in Higher Education Institutions (HEIs) from several viewpoints have been studied and defined three unique sector- and context-specific critical success factors (Abu Madi et al., 2024). D. G. Putra examined the impact of ERP system implementation on company performance, using organizational capabilities as a mediating variable. A study conducted by R. Raoof et al. investigated the influence of enterprise resource planning and entrepreneurial attitude on organizational performance (Raoof et al., 2021). Z. J. H. Tarigan examined the impact of enhanced ERP on organizational performance, emphasizing green supply chain management, supplier integration, and internal integration. Supplier integration influences green supply chain management and organizational success. Green supply chain management influences organizational success (Tarigan et al., 2021).

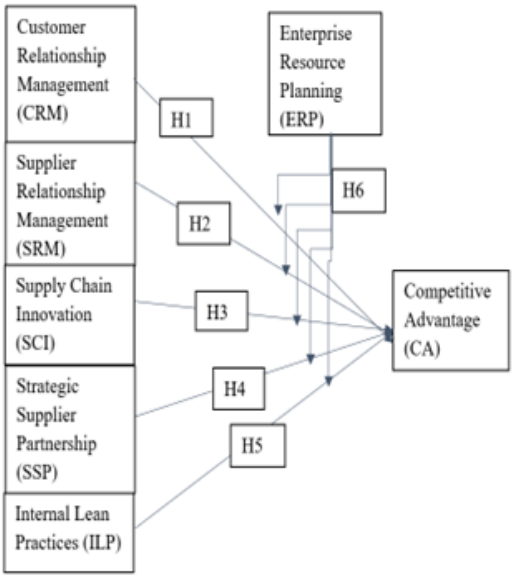
Thus, after reviewing the literature, the following hypotheses can be developed:

H1: Customer Relationship Management increases women-owned enterprises' Competitive Advantage.

H2: Supplier Relationship Management increases women-owned businesses' Competitive Advantage.
H3: Supply Chain Innovation increases women-owned businesses' Competitive Advantage.
H4: Strategic Supplier Partnership increases women-owned businesses' Competitive Advantage.
H5: Internal Lean Practices increase women-owned businesses' Competitive Advantage.
H6: Enterprise Resource Planning has a moderating effect on the relationship between SCM practices and Competitive Advantage.

3. Materials and methods

Figure 1: Workflow of the Key Variables



CRM and CA: SMEs embrace CRM because they work for large companies (Buttle et al., 2019). CRM affects market share and customer value (Alshura, 2018). Beating the competition demands actual client connections. Customer acquisition, retention, and competitiveness are connected. Alternatively, Aloqool et al. (2022) observed that CRM systems lose customers.

SRM and CA: Numerous firms increasingly see intermediaries as strategic partners that enhance responsiveness and competitiveness in light of fierce competition (Hult et al., 2007). Robust supplier relationships enable companies to get essential resources that would otherwise be difficult to acquire (Amoako-Gyampah et al., 2019). Supplier Relationship Management (SRM) may augment firm performance by minimizing expenses, improving quality, and innovating products (Demirbas et al., 2018). Collaborations enable firms to establish competitive advantages for suppliers and buyers, enhancing market share and profitability (Tseng, 2014). Supplier Relationship Management increases women-owned businesses' Competitive Advantage (Acquah, 2023).

SCI and CA: Numerous companies have prospered via innovation, which offers competitive advantages (Goksoy et al., 2013; Lim et al., 2010). Innovation establishes a competitive advantage via the production of distinctive goods, enhanced operational efficiency, or the provision of superior, cost-effective, and expedited services (Abd Aziz et al., 2016). E. Porter (1998) asserts that competitive advantage arises from optimizing production efficiency, producing superior goods and services, and assuring customer satisfaction (Distanont, 2020).

SSP and CA: Strategic Supplier collaboration delineates a company's supply chain partnership. It facilitates the success of the firm and its suppliers and intends to influence the competencies of all organizations (Li, et al. 2006). The partnership seeks to cultivate mutual advantages, including technological, product, and market benefits (Oshodin et al., 2021).

ILP and CA: By removing non-value-added procedures, lean management eliminates "waste". Lean internal processes

save money and time and improve product quality and customer satisfaction. SME lean implementations are often voluntary or driven by competition (Zhou, 2016).

***ERP and CA**:* ERPs connect finance, accounting, manufacturing, purchasing, and customer services (Sternad et al, 2011; Garg et al., 2017). Information Systems must adapt swiftly to market changes in contemporary companies (Phuong et al., 2012). Integrated ERP system performance studies vary per business, says Su et al., (2010). Integrated ERP systems are used in most companies; therefore, some believe they improve operational efficiency. This expensive and staff-intensive investment should improve supply chain management and performance (Aziz et al., 2018). Few studies relate ERP to competitive advantage (Chapman et al., 2009; Kallunki et al., 2011; Mzoughi et al., 2016). ERPs boost organizational efficiencies and competitiveness (Alomari et al., 2018). With accurate data, ERP systems let companies adapt and compete. ERP systems boost productivity, competitiveness, and profit (Siagian et al., 2018).

Qualitative data on the above variables were collected using surveys to examine SCM and competitive advantages. Every study component was assessed on a five-point Likert scale, including five Likert responses: strongly agree (5), agree (4), neutral (3), disagree (2), and severely disagree (1), and analyzed using SPSS software The questionnaire examined CRM, SRM (Gandhi et al., 2017), SCI (Kwak et al., 2018; Shamout, 2021), SSP (Al-Shboul et al., 2017; Khan et al., 2018; Li et al., 2006), ILP (Al-Shboul et al., 2017), and ERP (Ullah et al., 2017). The factors representing each variable under this structure are shown below:

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Field Survey Questionnaire

1. ***What does your company manufacture?***
2. ***How many employees does your company have?***

			Five Likert Scale				
Serial No	Variable	Factors	Strongly Agree (5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree (1)
1	CRM	Our firm frequently evaluates the formal and informal complaints of our customers.					
2		Our firm frequently measures and evaluates customer satisfaction and uses it to identify/determine customers' requirements.					
3		Our firm anticipates and responds to customers' evolving needs and wants.					
4		Customer focus is reflected in our business planning.					
5		Our firm actively seeks ways to improve the product/service in order to achieve greater satisfaction.					
6	SRM	Our firm relies on a few dependable and high-quality suppliers					
7		Our firm has helped our suppliers to improve their product quality.					
8		Our firm has a thorough supplier rating system based on which business is given to the suppliers.					

9	SCI	We pursue a cutting-edge system that can integrate information.					
10		We pursue technology for real-time tracking.					
11		We pursue continuous innovation in core supply chain processes.					
12	SSP	Our firm relies on a few dependable suppliers.					
13		Our firm considers the quality factor one of the main criteria in selecting our suppliers.					
14		Our firm has continuous improvement programs that include our key suppliers.					
15		Our key suppliers are included in new product development processes.					
16		Our suppliers deal with us in an open and honest way.					
17		Our suppliers have high reliability.					
18		Our transactions with suppliers don't have to be closely monitored/supervised.					
19		There is a willingness from our suppliers to provide us with a lot of assistance without exception.					
20		Our suppliers are highly committed to the agreements signed by us					
21	ILP	The firm's policy is looking to reduce set-up time.					
22		Suppliers' warehouses/factories are located very close.					
23		Time has been reduced for inspection of the incoming materials/components/Products.					
24	CA	We offer competitive prices.					
25		We offer products that are highly reliable.					
26		We offer products that are very durable					
27		We offer high-quality products to our customers.					
28		We deliver customer orders on time.					
29		We provide dependable delivery.					
30		We provide customized products.					
31		We respond well to customer demand for "new" features.					
32		We are first in the market in introducing new products.					
33		We have fast product development.					

Serial No	Variable	Factors	Extremely Good (5)	Good (4)	Neutral (3)	Bad (2)	Extremely Bad (1)
34	ERP	Our company's Enterprise Resource Planning state is-					
35		How will you rank system quality based on 'ease of navigation'?					
36		How will you rank system quality based on privacy?					
37		How will you rank system quality based on security?					
38		How will you rank information quality based on dynamic content?					
39		How will you rank information quality based on content personalization?					
40		How will you rank information quality based on the variety of information?					
41		How will you rank system use based on information search?					
42		Rate the process of receiving customer orders-					
43		Rate the process of accepting customer payments –					
44		Rate the process of customer service requests-					
45		Do you rank individual behaviour based on individual customer experience?					
46		How do you rank individual behaviour based on real-time marketing offers?					
47		How do sellers benefit from ERP in terms of global reach?					
48		How do sellers benefit from ERP in terms of customer loyalty?					
49		How do sellers benefit from ERP in terms of brand awareness?					
50		How do sellers benefit from ERP in terms of customer responsiveness?					

These components operate as independent factors, except ERP, which is a moderator. The dependent variable is Competitive Advantage (CA) (Li et al., 2006). Only agro-processing, fashion, healthcare, education, and pharmaceutical companies under 300 employees are sampled. The research assessed each independent variable's explanation of the dependent variable and the relationship between them using the following regression model:

$$CA = \alpha + \beta CRM + \beta SRM + \beta SCI + \beta SSP + \beta ILP + \beta ERP \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The population of this study is 3343. With a 95% confidence interval, Z, the Critical value (1.96) of the normal distribution gives 295 samples. The researcher selected 300 people for accuracy from five subsectors, but only 233 responded. Similar Indonesian research by Jahanbakhsh Javid et al. (2023) included 245 participants and 165 valid replies. Iqbal (2020) reported 383 Saudi SMEs, Tukamuhabwa et al. (2021) 234 Ugandan SMEs, and Quayle (2003) 288 companies.

1. Results and Discussions

4.1 Pairwise Correlation using ERP as Moderator

Table 1: Pairwise Correlations of Variables

		CA (Dependent Variable)	Zscore: CRM (Independent Variable)	Zscore: SRM (Independent Variable)	Zscore: SCI (Independent Variable)	Zscore: SSP (Independent Variable)	Zscore: ILP (Independent Variable)
Pearson Correlation	CA (Dependent Variable)	1.000	.836	.796	.107	.927	.419
	Zscore: CRM (Independent Variable)	.836	1.000	.710	.107	.836	.432
	Zscore: SRM (Independent Variable)	.796	.710	1.000	.138	.801	.360
	Zscore: SCI (Independent Variable)	.107	.107	.138	1.000	.082	.153
	Zscore: SSP (Independent Variable)	.927	.836	.801	.082	1.000	.409
	Zscore: ILP (Independent Variable)	.419	.432	.360	.153	.409	1.000
	Zscore: ERP (Moderator)	.583	.570	.394	.048	.560	.308
	Interaction_ERP_ CRM	-.822	-.799	-.658	-.227	-.800	-.423
	Interaction_ERP_ SRM	-.761	-.687	-.606	-.126	-.720	-.345
	Interaction_ERP_ SCI	.511	.443	.325	-.103	.487	.247
	Interaction_ERP_ SSP	-.876	-.792	-.683	-.103	-.844	-.397
	Interaction_ERP_ ILP	-.439	-.448	-.366	-.132	-.422	-.061

Source: Made using SPSS

Standardized expressions of independent, dependent, and moderator variables are presented in Table 1. The interaction term modifies the independent-dependent relationship. Based on the range for relationship strength, Table 1 shows that the moderator variable, enterprise resource planning, and the dependent variable, competitive advantage, have a significant and positive association. All other independent variables also posit a strong to medium but positive relationship with attaining a competitive advantage for the firms. This is consistent with the outcome, revealing that dependent and moderator variables seem linearly related (Zakaria et al., 2016).

4.2 Anova Test

Table 2: Model Summary of Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.937[a]	.879	.876	.1585

Source: Made using SPSS

Table 2 provides the model fitness score for explaining the hypothesized effects of independent variables on the dependent variable. It shows that independent factors can explain 87.6% of the dependent variable variability, signifying the proper model fitness to attain the purpose of the study.

Table 3: Output for ANOVA Test

ANOVA[a]						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	41.588	5	8.318	331.243	.000[b]
	Residual	5.750	229	.025		
	Total	47.338	234			

Source: Made using SPSS

The one-way ANOVA test compares group averages for significance. In Table 3, at "0.00", the ANOVA is statistically significant in this study, rejecting the null hypothesis, which means that at least one pair of group means is different. It also signifies that the moderator variable, ERP (Enterprise Resource Planning), duly plays a significant role in all the outcomes this study perceives.

4.3 Regression Analysis

Table 4: Regression Analysis of Standardized Variables

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.		
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	4.326	.036		120.256	.000		
	Z-score: CRM (Independent Variable)	.080	.019	.180	4.187	.000	.288	3.475
	Zscore: SRM (Independent Variable)	.056	.017	.126	3.228	.001	.349	2.869
	Zscore: SCI (Independent Variable)	.045	.086	.012	.524	.601	.962	1.039
	Zscore: SSP (Independent Variable)	.282	.021	.666	13.341	.000	.213	4.704
	Zscore: ILP (Independent Variable)	.010	.012	.021	.812	.418	.793	1.260
	Interaction_ERP_CRM	-.019	.015	-.063	-1.283	.201	.178	5.619
	Interaction_ERP_SRM	-.026	.014	-.070	-1.805	.072	.284	3.520
	Interaction_ERP_SCI	.115	.063	.109	1.817	.070	.117	8.517
	Interaction_ERP_SSP	-.055	.017	-.187	-3.177	.002	.122	8.190
	Interaction_ERP_ILP	.003	.011	.008	.286	.775	.579	1.728

Source: Made using SPSS

Table 4's 4.187 t-value strongly links CRM with 'Competitive Advantage'. This is a positive indication, i.e., CRM boosts competition. One CRM unit boosts CA 4.187-fold. 0.000 p-value indicates a high significance, denoting CRM promotes 'Competitive Advantage'. 'Supplier Relationship Management' impacts 'Competitive Advantage' (t=3.228). Improvements to SRM boost competitiveness as P=0.01 is significant. Supply Chain Innovation is 0.524 positive. The low-level shows insensitivity. Negligible P=0.601. Cannot reject the null hypothesis, inferring supply chain innovation may not boost company competitiveness. "Strategic supplier partnership" greatly impacts "competitive advantage" on 13.341, where the P value 0.000 matters for rejecting the null hypothesis. Adjusting "Internal Lean Practices" boosts "Competitive Advantage" (t=0.812). p-value 0.418 relating to its statistical insignificance, and also insufficient evidence to reject the null.

ERP-CRM connection is negligible (p=0.201). Disproving the null hypothesis appears difficult. ERP-SRM interaction p=0.072, 10% significance for rejecting the null hypothesis and inferring ERP moderates SRM-dependent variable association. A 10% moderate impact with a 0.070 p-value is significant. The criteria may reject the null hypothesis. ERP moderates supply chain innovation-competitive advantage. ERP-SSP p-value 0.002 is significant, also leading to null hypothesis rejection. An insignificant ERP-ILP interaction p-value is 0.775. The null hypothesis is non-rejectable. A VIF < 10 indicates no independent variable multicollinearity. According to the table, all independent variables have VIFs < 10. SSP has the highest VIF score at 4.704, while SCI has the lowest at 1.039.

4.4 Reliability Analysis

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.885
Bartlett's Test of Sphericity	Approx. Chi-Square	5385.910
	Df	741
	Sig.	.000

Source: Made using SPSS

A KMO of around 0.5 suggests factor analysis sample adequacy (accepted responses). Kaiser (1974) suggests 0.5 for KMO, 0.7–0.8 for sufficient. Table 5 above shows a KMO measure of 0.885, which is more than 0.8, making this sample size excellent (Nkansah et al., 2011). By determining whether the variables are strongly correlated rather than uncorrelated (an identity matrix), Bartlett's Sphericity evaluates whether a correlation matrix is appropriate for factor analysis. The test here yields 0.000, meaning all the variables used in the study are correlated in a manner that is totally different from an identity matrix, and therefore making factor analysis the perfect choice for this dataset analysis.

4.5 Factor Analysis

Table 6: Total Variance Explained

Total Variance Explained						
Initial Eigenvalues				Extracted Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.126	20.836	20.836	8.126	20.836	20.836
2	6.291	16.131	36.967	6.291	16.131	36.967
3	4.933	12.649	49.616	4.933	12.649	49.616
4	1.667	4.275	53.892	1.667	4.275	53.892
5	1.288	3.303	57.195	1.288	3.303	57.195
6	1.138	2.918	60.113	1.138	2.918	60.113
7	1.085	2.782	62.895	1.085	2.782	62.895
8	1.010	2.591	65.485	1.010	2.591	65.485
9	0.914	2.344	67.829			
10	0.892	2.286	70.115			
11	0.885	2.197	70.882			
12	0.882	2.123	71.556			
13	0.874	2.107	71.974			
14	0.866	2.095	72.337			
15	0.854	1.983	72.893			
16	0.847	1.874	73.312			
17	0.839	1.792	74.001			

18	0.826	1.756	74.987			
19	0.819	1.718	75.676			
20	0.803	1.691	76.462			
21	0.796	1.672	77.731			
22	0.788	1.614	78.085			
23	0.752	1.593	79.773			
24	0.749	1.552	80.017			
25	0.731	1.479	81.789			
26	0.729	1.380	82.587			
27	0.718	1.329	83.721			
28	0.705	1.299	84.800			
29	0.684	1.243	84.216			
30	0.671	1.201	85.399			
31	0.655	1.184	86.216			
32	0.628	1.173	87.545			
33	0.614	1.109	87.198			
34	0.602	1.015	88.780			
35	0.593	0.986	89.982			
36	0.589	0.972	90.077			
37	0.521	0.938	91.117			
38	0.507	0.878	92.587			
39	0.492	0.762	93.241			
40	0.483	0.708	94.396			
41	0.427	0.689	94.899			
42	0.395	0.621	95.021			
43	0.388	0.604	95.783			
44	0.364	0.591	96.891			
45	0.356	0.502	96.229			
46	0.325	0.497	97.110			
47	0.244	0.401	97.750			
48	0.216	0.369	98.367			
49	0.198	0.334	99.669			
50	0.162	0.303	100.00			

Each component's analysis-extracted eigenvalues are listed above. To count significant components or factors, variables must have eigenvalues greater than 1. Table 7 summarizes eight components out of 50 factors that have reached that significant level. First component explains 20.836% of variance, then 16.131%, 12.649%, 4.275%, 3.303%, 2.918%, 2.782%, and 2.591% respectively. The high values of loadings represent the strong relationship between the variable and its capacity to define the factors.

Due to the existence of cross-loading, where one or a few particular factors evaluate more than one component, factor loading has been relocated and distributed using the rotated component matrix for clearer expression of each variable, precisely measuring one factor.

Table 7: Rotated component matrix

Factors	Variables	F1	F2	F3	F4	F5	F6	F7	F8
CRM	Our firm frequently evaluates the formal and informal complaints of our customers.	0.913							
	Our firm frequently measures and evaluates customer satisfaction and uses it to identify/determine customers' requirements.	0.896							
	Our firm anticipates and responds to customers' evolving needs and wants.	0.874							
	Customer focus is reflected in our business planning.	0.803							
	Our firm actively seeks ways to improve the product/service in order to achieve greater satisfaction.	0.873							
SRM	Our firm relies on a few dependable and high-quality suppliers.		0.846						
	Our firm has helped our suppliers to improve their product quality.		0.831						
	Our firm has a thorough supplier rating system based on which business is given to the suppliers.		0.793						
SSP	Our firm relies on a few dependable suppliers.		0.769						
	Our firm considers the quality factor one of the main criteria in selecting our suppliers.		0.840						
	Our firm has continuous improvement programs that include our key suppliers.		0.872						
	Our key suppliers are included in new product development processes.		0.826						
	Our suppliers deal with us in an open and honest way.			0.781					
	Our suppliers have high reliability.			0.869					
	Our transactions with suppliers don't have to be closely monitored/supervised.			0.844					
	There is a willingness from our suppliers to provide us with a lot of assistance without exception.			0.793					
	Our suppliers are highly committed to the agreements signed by us			0.774					
ERP	Our company's Enterprise Resource Planning state is-			0.861					
	How will you rank system quality based on 'ease of navigation'?				0.856				
	How will you rank system quality based on privacy?				0.822				
	How will you rank system quality based on security?				0.785				
	How will you rank information quality based on dynamic content?				0.702				
	How will you rank information quality based on content personalization?				0.824				
	How will you rank information quality based on the variety of information?				0.752				

	How will you rank system use based on information search?					0.803			
	Rate the process of receiving customer orders-					0.787			
	Rate the process of accepting customer payments –					0.736			
	Rate the process of customer service requests-					0.691			
	Do you rank individual behaviour based on individual customer experience?					0.644			
	How do you rank individual behaviour based on real-time marketing offers?						0.866		
	How do sellers benefit from ERP in terms of global reach?						0.826		
	How do sellers benefit from ERP in terms of customer loyalty?						0.776		
	How do sellers benefit from ERP in terms of brand awareness?						0.655		
	How do sellers benefit from ERP in terms of customer responsiveness?							0.772	
SCI	We pursue a cutting-edge system that can integrate information.							0.730	
	We pursue technology for real-time tracking.							0.625	
	We pursue continuous innovation in core supply chain processes.							0.477	
ILP	The firm's policy is looking to reduce set-up time.								0.648
	Suppliers' warehouses/factories are located very close.								0.379
	Time has been reduced for inspection of the incoming materials/components/Products.								0.773

As per factor analysis, "Customer Relationship Management" has the highest impact on the competitive advantage of women-owned SMEs. Positive, substantial loadings represent a strong and meaningful association. All SMEs develop loyalty by managing customer connections and investigating official and informal complaints. Companies that poll and match demand boost customer involvement. CRM and competitiveness may improve by educating staff to retain customers. *Secondly,* "Supplier Relationship Management" affects "Competitive Advantage" as the next most significant factor. Most organizations start with reliable suppliers. Quality-based supplier selection benefits businesses. This report reveals 80% of 300 organizations use thorough supplier evaluation in business. Thus, women-owned enterprises have to be supplier-friendly. The notation is reassured with its third influential factor, which is strategic supplier partnership," positively affecting the dependent variable. Supplier partnership pillars quality, continuous improvement, and joint-effort problem solutions provide organizations with a market advantage and are statistically correlated. The survey showed that most organizations have a few trusted suppliers, choose based on quality, include their major suppliers in quality improvement, and employ various supplier engagement strategies. The fourth most influential factor is "Enterprise Resource Planning," which favors the dependent variable. For major organizations, local partners manage Oracle, SAP, and AX ERP. Regional software vendors will build and operate ERP systems for many enterprises. Global companies, textiles, government, semi-government, leasing, telecommunications, tourism, knit and garment, and others employ ERP systems. ERP protects data for most firms, according to studies. The fourth most important factor is 'Supply Chain Innovation', which influences 'Competitive Advantage' in a positive way. A few SME firms have started to invest in crucial supply networks that help to build up creative ideas and provide fast service.

Finally, the last, most significant factor, "Internal Lean Practices", has a strong and positive link with competitive advantage. Staff development and management issues prevent lean adoption, eliminating the connection. To save setup time, companies seek nearby supplier warehouses and facilities. Therefore, firms struggle to adopt lean. The report suggests measuring how often organizations utilize Kanban to improve JIT. Thus, "Internal Lean Practices" and "Competitive Advantage" fall behind about influence.

The research can be settled with the following summary of findings:

Hypotheses	Regression Analysis	Factor Analysis
H1: Customer Relationship Management increases women-owned enterprises' Competitive Advantage.	The Null Hypothesis is rejected.	Most Influential
H2: Supplier Relationship Management increases women-owned businesses' Competitive Advantage.	The Null Hypothesis is rejected.	Second Most Influential
H3: Supply Chain Innovation increases women-owned businesses' Competitive Advantage.	The Null Hypothesis is not rejected.	Fifth Most Influential
H4: Strategic Supplier Partnership increases women-owned businesses' Competitive Advantage.	The Null Hypothesis is rejected.	Third Most Influential
H5: Internal Lean Practices increase women-owned businesses' Competitive Advantage.	The Null Hypothesis is not rejected.	Sixth Influential
H6: Enterprise Resource Planning has a moderating effect on the relationship between SCM practices and Competitive Advantage.	The Null Hypothesis is rejected.	Fourth Most Influential

Customer relations increase corporate competitiveness, which aligns with previous studies, such as in automotive service sectors in the United Kingdom (Plakoyiannaki et al., 2008). CRM effectiveness increases with customer service training (Buttle et al., 2019). CRM boosts employee enthusiasm, talents, and perspective. Likewise, CRM helps Yemeni SMEs compete too (Alqershi et al., 2020). Most studies show SRM enhances competitiveness. However, firms, such as hotels, where SRM does not positively impact competitive advantage, performed differently, for example, a study conducted in the hospitality industry in Ghana (Ofori et al., 2022). Company competitiveness demands innovation. New ideas, supply chain innovations, and problem-solving make companies more competitive. Khan et al. (2008), Panayides et al. (2009), and Distanont, (2020) showed that innovative supply chains provide harder-to-copy goods and services, quicker reaction times, cheaper costs, and greater profitability. This study shows that Internal Lean Practices aid companies. Internal Lean Practices increase competitiveness in industrial companies in Iraq, according to Al-Jumaily et al. (2024). Research implies internal lean strategies work. Most research demonstrates that lean boosts production and efficiency. However, most respondents' companies saw minimal value in lean practices in product development, because few SMEs create products (Zhou, 2016). The results of ERP also align with other studies. ERP improves supplier relations and production (Siagian et al. 2018). Organizations must promptly identify appropriate suppliers, establish strategic partnerships, and work effectively to enhance performance and profitability. ERP facilitates access for suppliers and consumers via technological networking,

enabling a company to compete with open innovation systems (Uddin et al., 2020).

1. Conclusion

This study evaluated supply chain management in achieving competitive advantage for women-owned agro-processing, fashion, healthcare, educational, and pharmaceutical enterprises, which comes to the conclusion that supply chain management helps Bangladeshi women-owned SMEs better shape the landscape of their endeavors. In the process, ERP moderates this causal-effect relationship significantly. While CRM and SRM comes up as the most influential factors to achieve this competitiveness, further advancement in the line of sci and ILP shall be taken seriously as less-practiced areas. Further research can be redirected towards proposing studies involving bigger businesses with planning, information, sourcing inventory, production, transportation, and return to better comprehend Supply Chain Management. To maximize the findings, management shall focus on developing an effective SME-SCM plan incorporating all supporting policies and environments, durable and effective institutions offering efficient collaboration, and access to financial and business technology, and government-backed risk assessment strategies for poor but competent entrepreneurs. Digitalization, government incentives, and a strong regulatory framework shall be implemented for displaying resilience in even setbacks faced by women-owned SMEs.

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