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Determinants Impacting the Assimilation Stages of E-commerce in SMEs: A Modified TOE Framework

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ABSTRACT

This article aims to examine the factors affecting e-commerce assimilation in Indian SMEs. It proposes a research model based on the technology, organization, and Environment (TOE) framework that includes technological, organizational, environmental, and individual determinants of e-commerce adoption and assimilation. Survey data from 384 SMEs in North India reveals that technological, organizational, environmental, and individual (TOEI) determinants explain e-commerce adaptation**.** The results show that although Indian SMEs are adopting e-commerce, they cannot reach the final integration stage. Although all factors significantly influence the e-commerce assimilation in SMEs, technological factors have emerged as the most influential predictors of e-commerce adoption among the other elements, viz. The technological context directly affects e-commerce adaptation through organizational, environmental, and individual compatibility.

In contrast, technological cost and perceived risk are the most crucial factors inversely impacting e-commerce adaptation. Therefore, managers, policymakers, and government should focus on developing technical infrastructure and providing technical support to SMEs to promote e-commerce integration. It will help them to take advantage of the opportunities that e-commerce offers.

Keywords: E-commerce, Assimilation, adoption, SMEs, TOE Framework

1. INTRODUCTION

Electronic commerce has brought about a metamorphosis in business transactions. Internet-based marketing has opened various options for organizations to build a new customer base and expand their operation. E-commerce diminishes different processes, improves the quality of products & services, triggers new customer and supplier penetration, and provides new avenues for product distribution. Many large organizations are reaping the benefits, but SMEs are not fully utilizing it due to constraints. SMEs' share and contribution are enormous in developed and developing countries [1]. Although SMEs have increasingly realized the benefits of e-commerce

and started using it, they are still lagging in its full utilization and implementation. As per data from the MSME Ministry India, as of March 24, 2022, India also had 6.3 crores of MSMEs in total [2]. It contributes to about 611% of the manufacturing GDP and 24.63% of the GDP from service activities, and 33.4% of India's manufacturing output [2]. It has been evident from the facts and studies that very few studies are available focused on the extent of adoption in SMEs [3, 4].

A few researchers utilize the theory of assimilation to investigate the results of technology assimilation research [5, 6]. The current research aims at contributing to the extant literature in the following ways:

(1) This research is the first to provide in-depth insights into the assimilation of e-commerce in SMEs.

(2) It also investigates the various levels of impact of determinants on the assimilation of e-commerce in SMEs.

2. LITERATURE REVIEW

2.1 Adoption and Assimilation

According to Rogers [7], adoption is a choice to fully utilize innovation as the best strategy, while rejection is a choice not to embrace an accessible advancement. The researcher in this paper defines adoption as implementing the latest technologies along with three levels, i.e., firm, group, and individual. Hence, in this paper, we have focused our research on calculating e-commerce adoption at the organizational level.

Assimilation is the level of technology integration across an organization's working operations. It explains the extent of adopting technology integrated into the organization system for conducting day-to-day activities. For example, E-commerce assimilation is "the degree to which a firm uses Internet innovations to encourage the company's e-business procedures and activities intended for marketing, advertising, and buying and selling products and services in SMEs."

Hence in the present study, adoption and assimilation are viewed and studied as a process commonly segmented into various phases and not a once-off event.

Another framework proposed by [8] explores the unfolding of B-to-B e-commerce adoption in SMEs by a stage model that differentiates non-adopters from adopters through six stages process, which engulfs the level of complexity of e-commerce applications

2.2 Stages of Assimilation

The extant literature provides a five-stage framework to measure e-commerce assimilation**.** Which is very much similar to the [8] stage model for e-commerce penetration, which is as follows:

Stage 0 Non-adoption: This level of e-commerce adoption involves the non-acceptance of e-commerce technologies due to some hindrances.

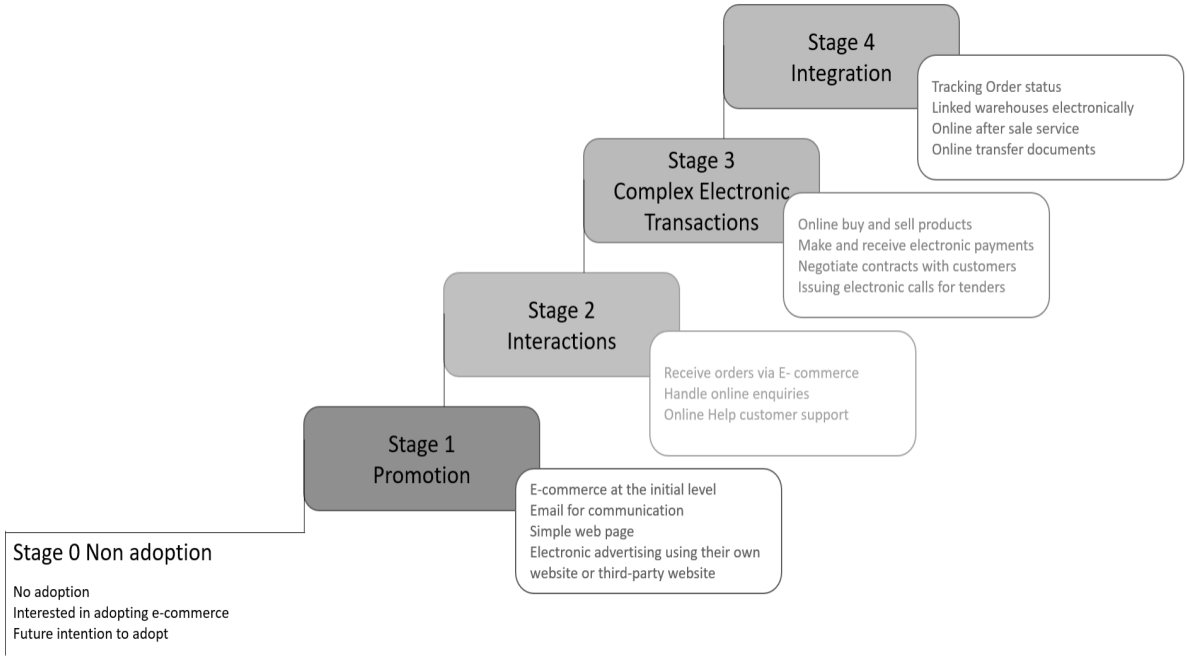
Stage 1 Promotion: The firms operate at the electronic Information search and content creation level [8].

Stage 2 Interactions: This is the stage of two-way communication. This stage starts and enhances the integration of business and consumers (B2C) and business-to-business (B2B).

Stage 3 Complex Electronic Transactions: This stage of e-commerce assimilation involves complex online financial transactions. This stage increases the level of involvement electronically through web portals, where the organization and customer can participate through virtual communities and share helpful information. In addition, it involves integrating an electronic payment system and auctions to facilitate sellers to offer their products online to buyers via web portals.

Stage 4 Integration: The final and most advanced assimilation stage fully utilizes e-commerce. It includes components like consumer relationship management (CRM) and supply chain management (SCM) through electronic mediums. In other words, all the business activities are integrated through web channels and coordinated in an online environment, like tracking the live status of any product in the system.

Figure 1: Representation of the Five stage framework of E-commerce assimilation



Source: Author's own adapted representation

2.3 Research Model and Hypotheses Development

The TOE framework identifies three-facet of a firm's context that influences its assimilation of technological innovation Technological context, Organizational context, and Environmental context [9, 10]. This study considers individual factors separately.

We examine the individual context**,** which **is** the characteristics of the owner-entrepreneur**,** to determine their adoption of e-commerce. This framework is consistent with the innovation diffusion theory of adoption [7].

Determinants Impacting the Adoption and Assimilation of E-commerce in SMEs
In this study, the researcher has adopted a four-dimension research framework for reviewing the factors affecting e-commerce adoption and assimilation in SMEs that have slightly modified from the [9].

Technological Factors comprise factors related to the technical background and expertise and matching with the organization's environment like the relative advantage, perceived benefit, compatibility, and cost. These factors are related to the organization's availability and technical effectiveness and play a vital role in adopting e-commerce [11-13]. Relative advantage refers to the benefit to the organization using particular technology and results in increasing effectiveness and cost reduction [14-18]. Analysts have strongly connected relative advantage, e-commerce adoption [19-22], and assimilation [23, 24]. Compatibility calculates the level of easiness in using the technology or is in tune with technology support, working culture, corporate value, and work practices currently prevailing in the firm [14, 25-27]. Organizations will quickly accept innovation if it aligns with their existing policies, satisfies their needs, and harmonies with the organizational culture [19], [28, 29]. The present study explored that cost is an essential element affecting the adoption and assimilation of e-commerce technologies. It is evident from previous studies that the organization quickly adopts and assimilates technologies or innovations that are less expensive**.** [16, 25, 27, 30-33].

The study has also explored the security concerns and risks associated with e-commerce adoption. The fear of hackers and online theft hinders organizations, especially SMEs, from adopting the online platform in their business using e-payment systems and exchanging electronic documents**.** [17, 26, 34]. The risk would obstruct e-business usage among organizations [32, 35]. Therefore, these explanations lead to the following alternate hypothesis:

H.1: Technological factors have a significant relationship with the assimilation of e-commerce
H.1a: Relative advantage has a significant relationship with the assimilation of e-commerce
H.1b: Compatibility has a significant relationship with the assimilation of e-commerce
H.1c: Perceived Risks have a significant relationship with the assimilation of e-commerce
H.1d: Technology Costs have a significant relationship with the assimilation of e-commerce

Organizational Factors The organizational context engulfs the various factors that are present internally in an organization that will directly influence a technology innovation assimilation and implementation [12, 13, 36]. Technology readiness is one of the

organizational variables considered in this study as a principal factor that impacts SMEs in assimilating e-commerce. Technology readiness refers to the level of preparedness of the organization in terms of IT infrastructure [37], adaptable systems, and employee expertise in an organization [38] that can support e-commerce adoption and assimilation [16, 39-42]. Strategic orientation includes an organization's vision and inclination towards change to benefit from the latest technologies [43-47]. Thus, in this study, It is hypothesized that

H.2: Organizational factors have a significant relationship with the assimilation of e-commerce
H.2a: Technology readiness has a significant relationship with the assimilation of e-commerce
H.2b: Strategic orientation has a significant relationship with the assimilation of e-commerce

Environmental Factors: Some external factors have influenced the SMEs, like competitors, government, and vendors or suppliers, that directly or indirectly affect the functioning of the business organizations and have a significant impact on the assimilation of e-commerce [11, 13, 18, 36]. It includes external influences and uncertain conditions an organization faces, which affect its performance and pressure the organization to update itself to gain a competitive advantage technologically. These factors include pressure from customers/suppliers and competitors [12, 22, 30, 46, 48]. Usually, the major environmental forces in SMEs' e-commerce assimilation are external pressure from trading partners such as suppliers and customers [17, 33, 40] and competitive pressure [16, 33, 49]. In addition, technology Vendor's Support-commerce necessitates using integrated and electronically compatible trade systems to connect businesses with their partners and enable them to exchange services via the Internet [40]. As a result, technology suppliers might be the primary source of outside IT expertise and a critical factor in SMEs' adoption of IT. [25, 27, 47, 49-51].

Government Support, the government's support in helping the SMEs with various schemes and policies proves to be very helpful as it always works for the proliferation of e-commerce in SMEs [14, 52]. The government of any nation can analyze its support for SMEs by examining the supportive policies and schemes they provide. [53], provision of financial and technological assistance [16], development of IT infrastructure [54], and constituting by-laws in support of e-commerce adoption by SMEs [29, 48]. Some studies have emphasized the National infrastructure as an essential determinant [33, 55]. Hence these explanations lead to the following alternate hypothesis.

H.3: Environmental factors have a significant relationship with the assimilation of e-commerce.
H.3a: External pressure has a significant relationship with the assimilation of e-commerce.
H.3b: Technology Vendor support has a significant relationship with the

assimilation of e-commerce
H.3c: The government's support has a significant relationship with the assimilation of e-commerce.

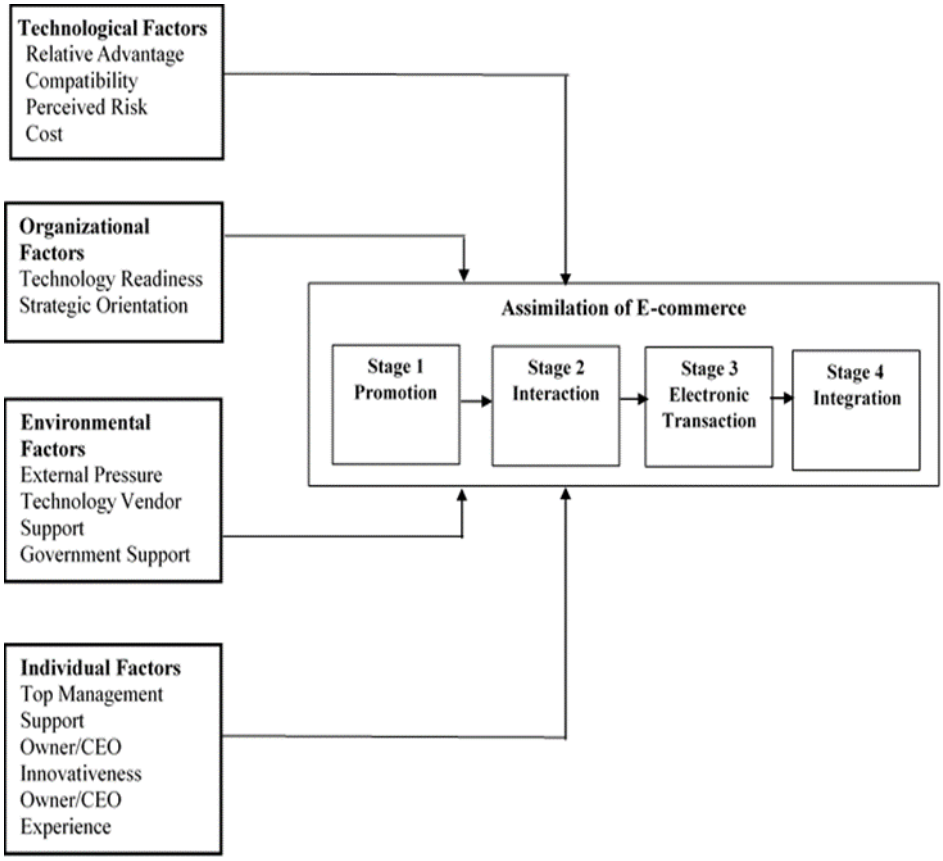
Individual Factors Various studies have included this factor under the broad basket of organizational factors. The owner/top manager directly determines SMEs' planning and implementation policies. [17, 43]; hence, the present study has included individual contexts separately to get a more detailed and realistic view. Top Management Support/Championship implies the level of involvement and engagement in making decisions about the implementation and execution of any technological advancement in an organization, as they are the primary decision-makers and are more prone to adopting innovative technology. It has been considered in the following research [5, 33, 42, 47, 53, 56]. The owner's innovativeness indicates the level of keenness the owner has possessed for learning and accepting new and latest techniques for usage in their organization to reap the various benefits. Considerable research in the same domain has quoted this factor as an essential element [25, 27, 54, 57, 58]. The innovativeness of the SME owner leads to having a positive intention to adopt an e-commerce application [50, 59]. Owner/CEOs Education /Experience refers to the capacity and ability of the top managers in terms of academic and professional experience; Many researchers have observed education and experience to be dominant variables in the development and implementation of the latest technologies [16, 32, 50, 54, 57]. Thus, it derives the hypothesized that

H.4: Individual factors have a significant relationship with the assimilation of e-commerce

H.4a: Top Management support has a significant relationship with the assimilation of e-commerce
H.4b: Owner/CEO innovativeness has a significant relationship with the assimilation of e-commerce
H.4c: Owner/CEO experience has a significant relationship with the assimilation of e-commerce

Research Framework

Figure 2. A Modified Model of the TOE Framework of E-Commerce Assimilation



Source: Adapted and modified from TOE framework (Tornatzky et al., 1990)

3. RESEARCH METHODOLOGY

This study comes under the category of a positivist research paradigm; Hence the researcher has used the survey method to collect the data through a structured questionnaire. Furthermore, since the current research examines e-commerce assimilation amongst Indian SMEs, the population of interest includes the management staff of Indian SMEs. Therefore, the sampling process involves selecting Indian SMEs that vary in size and business sectors in significant North Indian cities (i.e., Delhi NCR, Meerut, Moradabad, Muzaffarnagar, Aligarh, Khurja, and Agra).

3.1 Sampling and Data-Collection Procedures

Although no official data on the number of businesses engaged in these sectors is readily available in India, the database of National Small Industries Corporations (NSIC) is the most reliable source for obtaining a list of Indian MSMEs (Mico small and medium enterprises) along with other sources like Business Directories of individual cities. The sample is selected from the major cities of Uttar Pradesh and Delhi NCR, as they constitute the majority of the industrial area of North India. According to a report by [2], the State of Uttar Pradesh had the most significant number of estimated MSMEs,

with a share of 14.20% of MSMEs in the country. This research adopted personal distribution of questionnaires using Judgemental (purposive) sampling in conjunction with referral-based response sampling on social media.

Sample Size: The research took a sample of 384 for this exploration. Three techniques determined the sample size,

Firstly according to [60], "sample size is influenced by the average size of samples in similar studies," and in the case of non-probability sampling, these sample sizes can serve as rough guidelines in determining the actual sample size of our study, Secondly according to [61] "the minimum number of sample size is to have at least five times as many observations, and the number of variables to be analyzed and more acceptable sample size would have 10:1 ratio,

Finally, sample size determination is also done by G Power Analysis [62] using the software and found the sample size to be 275, using actual power: 0.800 and odd ratio as:1.833.

3.2 Measurement of Variables and Instrument Validation

This research adopted items from authentic sources to ensure reliability and validity in the survey instrument**.** The technological context was measured using 13 scale items about relative advantage [20], compatibility [20, 39], perceived risk [63], and cost [27]. The organization construct uses seven items to collect data about technology readiness [20] and strategic orientation [20]. The environmental context was measured using 11 items relating to external pressure [49], technology Vendor support [20], and government support [20]. The individual construct uses eleven items to collect data about [20], owner/CEO innovativeness [64], and owner/CEO experience [64]. The dependent variable was measured using 20 items about the assimilation of e-commerce [8]. A 7-point Likert scale**,** with**'**1' representing strong disagreement and '7' expressing strong agreement, was used to measure all the items.

Test of reliability, validity, and identification of factors

The Cronbach alpha values are in Table 1. This value far exceeds the minimum standard of 0.7 sets by [65]. The values generate a strong indication that there is an internal consistency in the measurement.

Validity

Content Validity determines whether an instrument accurately represents the subject matter. The questionnaire has content validity based on a thorough review of the literature and the opinions of professionals in the field of e-commerce.

Construct validity: The degree to which the elements on a scale measure the same notion is known as construct validity. The researcher investigated SMEs' intent to adopt e-commerce using essential survey interval-scaled questions and exploratory factor analysis to identify underlying constructs and relationships. The current study examined 42 items of the research constructs**,** separately for the following four constructs:

Technological, Organizational, Environmental, and Individual. In addition, the researcher ran **a** Bartlett sphericity test before conducting EFA to determine if the data were suitable for factor analysis. During EFA, the Principal Component Analysis technique with Promax rotation considered eigenvalue more significant than one and factor loadings greater than 0.3 [66].

Table 1. Calculation of Cronbach Alpha

S.No	Construct	Value	No of items
1	Relative Advantage	0.982	4
2	Compatibility	0.96	3
3	Perceived Risk	0.947	3
4	Cost	0.956	3
5	Technology Readiness	0.971	4
6	Strategic Orientation	0.939	3
7	External Pressure	0.956	3
8	Technology Vendor's support	0.98	4
9	Government's Support	0.96	4
10	Top Management Support	0.982	4
11	Owner/CEO Innovativeness	0.973	4
12	Owner/CEO Experience	0.939	3
13	Overall Scale	0.929	42

Convergent Validity: The Thumb Rule for assessing the convergent validity is that if the AVE value is higher than 0.50, it indicates a higher convergent validity [61]. In this study, the entire AVE value is more significant than 0.5. See Table 2.

Table 2. Convergent Validity

Factors with Items Loaded in Each Factor	Factor Loading λ	Square of Factor Loading λ^2	Average Variance Extracted AVE	Convergent Validity
Technological Factors				
RA1	.972	0.945	0.938876	AVE > 0.5 Convergent Validity Confirm
RA3	.970	0.942		
RA4	.970	0.940		
RA2	.963	0.928		
CT1	.984	0.969	0.920442	AVE > 0.5 Convergent Validity Confirm
CT3	.968	0.938		
CT2	.925	0.855		
CM2	1.00	1.013	0.914823	AVE > 0.5 Convergent Validity Confirm
CM3	.940	0.884		
CM1	.921	0.848		
PR3	.996	0.992	0.897012	AVE > 0.5 Convergent Validity Confirm
PR1	.991	0.983		
PR2	.846	0.716		
Organizational factors				
TR2	.965	0.932	0.9158	AVE > 0.5 Convergent Validity Confirm
TR4	.962	0.925		
TR3	.961	0.924		
TR1	.939	0.882		
SO3	.991	0.982	0.873	AVE > 0.5 Convergent Validity Confirm
SO2	.984	0.969		
SO1	.819	0.670		
Environmental Factors				
TVS1	.972	0.945	0.939	AVE > 0.5 Convergent Validity Confirm
TVS3	.970	0.942		
TVS2	.970	0.940		
TVS4	.963	0.928		
GS4	.984	0.969	0.943	AVE > 0.5 Convergent Validity Confirm
GS3	.968	0.938		
GS1	.925	0.855		
GS2	1.006	1.013		
EP2	.940	0.884	0.908	AVE > 0.5 Convergent Validity Confirm
EP3	.921	0.848		
EP1	.996	0.992		

Table 2. Convergent Validity

Factors with Items Loaded in Each Factor	Factor Loading λ	Square of Factor Loading λ^2	Average Variance Extracted AVE	Convergent Validity
Individual Factors				
OI1	.972	0.945	0.912	AVE > 0.5 Convergent Validity Confirm
OI2	.961	0.923		
OI3	.944	0.890		
OI4	.944	0.890		
MS1	.977	0.955	0.927	AVE > 0.5 Convergent Validity Confirm
MS4	.972	0.946		
MS3	.953	0.908		
MS2	.949	0.901		
OE2	1.000	1.000	0.853	AVE > 0.5 Convergent Validity Confirm
OE3	.973	0.947		
OE1	.781	0.611		

Discriminant Validity: In the calculation of discriminant validity following observations are shown in Table 3. All the Squared correlations between constructs $\mathbf{(r)^2}$ are less than AVE, and with the thumb rule, If $\mathbf{(r)^2}$ < AVE, then it indicates discriminant validity between the constructs [61].

Table 3. Discriminant Validity

S.No.	Relationship Between Constructs	AVE	r	Squared Correlation ($r^{2)}$	Discriminant Validity
1	RA & CT	0.930	-0.416	0.173	$\mathbf{(r)^2}$ < AVE Confirmed
2	RA & CM	0.927	0.535	0.286	$\mathbf{(r)^2}$ < AVE Confirmed
3	RA & PR	0.918	-0.452	0.204	$\mathbf{(r)^2}$ < AVE Confirmed
4	CT & CM	0.918	-0.353	0.125	$\mathbf{(r)^2}$ < AVE Confirmed
5	CT & PR	0.909	0.305	0.093	$\mathbf{(r)^2}$ < AVE Confirmed
6	CM & PR	0.906	-0.544	0.296	$\mathbf{(r)^2}$ < AVE Confirmed
7	TR & SO	0.894	0.556	0.309	$\mathbf{(r)^2}$ < AVE Confirmed
8	TV & GS	0.941	0.565	0.3192	$\mathbf{(r)^2}$ < AVE Confirmed
9	TV & EP	0.923	0.663	0.4396	$(r)^2$ < AVE Confirmed
10	GS & EP	0.925	0.526	0.2767	$(r)^2$ < AVE Confirmed
11	OI & MS	0.919	0.605	0.36	$(r)^2$ < AVE Confirmed
12	OI & OE	0.882	0.557	0.31	$(r)^2$ < AVE Confirmed
13	MS & OE	0.890	0.635	0.40	$(r)^2$ < AVE Confirmed

4. RESULTS

4.1 Data-Analysis Procedures

The research sample included the 550 SMEs listed with NSIC (National Small Scale Industries Corporation India). The researcher personally reached out to the identified respondents telephonically to solicit their involvement in the study. Some responders consented to personal interviews during this process. A total of 450 completed questionnaires were received (response rate of 81%). After the preliminary screening for incomplete information, the study used 384 questionnaires for the final analysis.

Data Analysis

The data were analyzed using multinomial logistic regression analysis following the guidelines established by [61]. Regression analysis aims to relate a dependent variable to a group of independent factors and determine each independent variable's capacity to explain the dependent variable [67]. Multinomial logistic regression does not presume normality, linearity, or homoscedasticity, while the study verified other assumptions before executing the test**.**

Multinomial Logistic Regression

Parameters Estimate Summary

It has been observed from Table 3 that all the independent are significant in specific categories of assimilation (0, 1, 2, and 3) of dependent variables from the reference category 4 of the dependent variable at ($p < 0.05$).

Table 4. Parameters Estimates

Level of assimilation	**0**	**1**	**2**	**3**
	β Coeff (p-value)	**β Coeff (p-value)**	**β Coeff (p-value)**	**β Coeff (p-value)**
TOEI Factors				
Technological Factors	**0**	**1**	**2**	**3**
Intercept	19.461 (.005) *	33.442 (.000)	30.328 (.000)	28.622 (.000)
Relative Advantage	-0.977 (0.000)	-.881 (.000)	-.852 (.000)	-.649 (.000)
Compatibility	-1.950 (.000)	-1.471 (.000)	-1.291 (.000)	-.880 (.000)
Perceived Risk	1.252 (.000)	1.054 (.000)	1.082 (.000)	.703 (.000)
Technology Cost	1.194 (.000)	.118 (**.253**)	.180 (**.060**)	-.161 (**.026**)
Organizational Factors	**0**	**1**	**2**	**3**
Intercept	75.561 (.000)	70.954 (.000)	68.121 (.000)	51.685 (.000)
Technology Readiness	-.915 (.000)	-.690 (.000)	-.531 (.000)	-.244 (.000)
Strategic Orientation	-3.555 (.000)	-3.334 (.000)	-3.248 (.000)	-2.443 (.000)

Table 4. Parameters Estimates

Level of assimilation	**0**	**1**	**2**	**3**
	β Coeff (p-value)	**β Coeff (p-value)**	**β Coeff (p-value)**	**β Coeff (p-value)**
Environmental Factors	**0**	**1**	**2**	**3**
Intercept	77.215 (.000)	74.176 (.000)	71.665 (.000)	57.088 (.000)
External Pressure	-2.745 (.000)	-2.643 (.000)	-2.516 (.000)	-1.831 (.000)
Technology Vendor Support	-.500 (.020)	-.365 (.024)	-.400 (.013)	-.336 (.029)
Government Support	-1.067 (.000)	-1.067 (.000)	-.902 (.000)	-.687 (.000)
Individual Factors	**0**	**1**	**2**	**3**
Intercept	85.764 (.000)	82.512 (.000)	81.503 (.000)	66.329 (.000)
Management Support	-.371 (.003)	-.231 (.063)	-.238 **(.053)**	-.200 **(.078)**
Owner/CEO Innovativeness	-.716 (.000)	-.679 (.000)	-.597 (.000)	-.374 (.002)
Owner/CEO Experience	-3.718 (.000)	-3.628 (.000)	-3.598 (.000)	-2.834 (.000)

* represent significance at 5%

The comparison group is the Fourth Level of Assimilation

Table 5. Likelihood Ratio Tests and Exponentials of Coefficient

Level of assimilation			**0**	**1**	**2**	**3**
TOEI Factors	**Likelihood Ratio Tests**		**Exponentiation of the coefficients**			
Technological Factors	Chi-Square	Sig.	Exp B	Exp B	Exp B	Exp B
Relative Advantage	73.194	.000	.377	.414	.426	.522
Compatibility	182.634	.000	.142	.230	.275	.415
Perceived Risk	57.072	.000	3.497	2.870	2.950	2.021
Technology Cost	127.074	.000	3.302	1.125	1.197	.851
Organizational Factors						
Technology Readiness	186.795	.000	.400	.502	.588	.783
Strategic Orientation	257.516	.000	.029	.036	.039	.087
Environmental Factors						
External Pressure	211.248	.000	.064	.071	.081	.160
Technology Vendor Support	26.494	.000	.607	.694	.671	.715
Government Support	113.453	.000	.344	.352	.406	.503
Individual Factors						
Management Support	27.412	.000	.690	.794	.788	.819
Owner/CEO Innovativeness	80.372	.000	.489	.507	.550	.688
Owner/CEO Experience	202.348	.000	.024	.027	.027	.059

All the predictors are significant as (*p =.000)* by the Likelihood ratio test of multinomial logistic regression. Considering the Exp B (Exponential of coefficients),

Based on the result in Table 5. Considering the value of Exp B, for each unit increase in the independent variable, the probability of adoption at the zero-level decreased by a certain percentage (Exp B - 1.0.) %. Similarly, the likelihood at different levels can be computed and represented in Table 6.

4.2 Assessment of Factors at Various Stages of e-commerce assimilation

In Table 6, the impact of each factor is analyzed as with every unit increase in the elements, the probability of remaining in the stage (current) as compared to the fourth stage (Maximum assimilation) will decrease or increase by a certain percentage. Therefore, it means the chances of remaining in the current stage will increase or decrease by a certain percentage concerning the fourth stage.

Table 6. Probability at different levels of assimilation

Factor/Stages	**0**	**1**	**2**	**3**
Technological Factors	Probability (chances) of remaining in the current stage compared to the fourth stages			
Relative Advantage	62.3 % (chances decrease)	58.6 % (chances decrease)	57.4% (chances decrease)	47.2% (chances decrease)
Compatibility	39.9% (chances decrease)	77 % (chances decrease)	72.% % (chances decrease)	58.5% (chances decrease)
Perceived Risk	300 % (chances Increase)	100 % (chances Increase)	100 % (chances Increase)	100 % (chances Increase)
Technology Cost	300 % (chances Increase)	50 % (chances Increase)	50 % (chances Increase)	50 % (chances Increase)
Organizational Factors	Probability of remaining in the current stage compared to the fourth stages			
Technology Readiness	60 % (chances decrease)	49.8% (chances decrease)	41.2% (chances decrease)	21.7% (chances decrease)
Strategic Orientation	97.1% (chances decrease)	96.4% (chances decrease)	96.1% (chances decrease)	91.3% (chances decrease)
Environmental Factors	Probability of remaining in the current stage compared to the fourth stages			
External Pressure	93.6% (chances decrease)	92.9% (chances decrease)	91.9% (chances decrease)	84% (chances decrease)
Technology Vendor Support	39.3% (chances decrease)	30.6% (chances decrease)	32.9% (chances decrease)	28.5% (chances decrease)
Government Support	65.6% (chances decrease)	64.8% (chances decrease)	59.4% (chances decrease)	49.7% (chances decrease)

Table 6. Probability at different levels of assimilation

Factor/Stages	0	1	2	3
Individual Factors	Probability of remaining in the current stage compared to the fourth stages			
Management Support	31 % (chances decrease)	20.6% (chances decrease)	21.2% (chances decrease)	18.1% (chances decrease)
Owner/CEO Innovativeness	51.1 % (chances decrease)	49.3% (chances decrease)	45% (chances decrease)	31.2% (chances decrease)
Owner/CEO Experience	97.6% (chances decrease)	97.3% (chances decrease)	97.3% (chances decrease)	94.1% (chances decrease)

4.3 Model Fitting Information

The Likelihood test ratio was used to ascertain the relationship between the independent variables and the dependent variable, where the probability of the model chi-square (given in Table 7.) was 0.000, less than the level of significance of 0.05 (i.e., $p<0.05$). Similarly, **Pseudo R Square** estimate the strength of the relationship; they indicate the variation in the dependent variable used in the model.

Table 7. Model Fit information

	Model Fitting Criteria	**Likelihood Ratio Tests**		**Pseudo R square**	
Factors	2 Log likelihood	Chi-Square	Sig.	Cox and Snell	Nagelkerke
Technological Factors	481.125	688.329	.000	.833	.875
Organizational Factor	456.318	632.874	.000	.808	.848
Environmental Factor	551.939	611.523	.000	.797	.836
Individual Factor	559.956	591.493	.000	.786	.825

5. DISCUSSION

The study's main objective is to find the impact of various factors on the assimilation of e-commerce. Considering the multiple elements of technological construct, Relative advantage and compatibility are significant predictors of e-commerce assimilation, and perceived risk and technology cost is associated with decreased intentions to assimilate e-commerce initiatives; Previous studies also represent a similar relationship pattern (Table 8.) Reflections shown in Table 6 justify that security and cost as the most critical barrier to assimilating e-commerce. Similarly, in the Organizational construct, it is observed that both strategic orientation and technology readiness significantly affect the adoption and assimilation of e-commerce and are positively correlated with the adoption and assimilation. The result corroborates the finding of similar studies in Table 8. Henceforth in environmental construct, External Pressure, Technology Vendor

Support, and Government Support positively correlate with the adoption and assimilation of e-commerce. The findings of the studies are evident from previous research in Table 8. Lastly, in individual constructs, CEO/Owner Innovativeness, CEO/Owner Experience, and Top Management Support significantly affect the adoption and assimilation of e-commerce and are positively correlated with the adoption and assimilation. It is also evident from the previous studies in Table 8.

Table 8. Review of results of previous studies

Discussion of Comparative Results		
S.No	Factors	Previous studies indicating a significant effect on Assimilation
1	Relative Advantage	[14, 16-18, 20, 25, 26, 28, 42, 49, 55, 64, 68-71]
2	Compatibility	[25, 26, 28, 35, 49, 64, 69, 72, 73] [18, 20, 42, 50, 74]
3	Perceived Risk	[18, 20, 26, 35, 54, 72, 75, 76]
4	Technology Cost	[18, 20, 25, 29-32, 35, 49, 54, 69, 75]
5	Strategic Orientation	[5, 20, 43-45, 68]
6	Technology Readiness	[13, 20, 30, 39-41, 45, 50, 68, 72, 74, 77]
7	External Pressure	[13, 14, 18, 20, 30, 42, 49, 54, 56, 64, 68, 69, 74, 75, 78]
8	Technology Vendor's Support	[25, 64, 69, 79]
9	Government Support	[13, 14, 16, 18, 39, 40, 53, 54, 79]
10	CEO/Owner Innovativeness	[25, 35, 50, 57, 69, 80]
11	CEO/Owner Experience	[45, 50, 57, 78]
12	Top Management Support	[5, 13, 18, 20, 29, 40, 41, 51, 55, 56, 75, 79, 81]

This study helps determine the relationship and impact of different factors under the TOEI framework on implementing and integrating e-commerce at various levels.

Multinomial logistic regression results provide rich evidence for e-commerce assimilation. The author has proposed the four levels of the adoption model, and the chances or probability of adoption patterns at each level is also estimated, Table 6. It is evident from the results in Table 6. that for each factor, the probability of a particular factor remaining at the current level (from zero to 4) decreases by different percentages as the level of assimilation increases. The conclusion is that each element has a dominant effect on increasing the odds or rate of adoption as adoption rises from the initial stage to the highest level of e-commerce assimilation. All the technological factors except cost and risk show a similar growth pattern in e-commerce adoption and reflect that the elements have different adoption percentages at each level. Hence we can derive the importance and usability of each factor at different levels. Like Relative advantage was observed as a significant element at zero level to the fourth level stage

because the chances of remaining at (zero level) no adoption stage decreased to 62.3% compared to the (Highest) fourth level stage adoption. Similarly, organizational, environmental, and individual factors also depict the same pattern of assimilation at different levels. This body of knowledge will help the researchers and policymakers to explore the assimilations levels and the importance and impacts of the factors at each level.

Implications of the Study

Theoretical Implications

Technological factors are the most important predictors of e-commerce assimilation among the other factors, viz. organizational, environmental, and individual. Technological compatibility emerged as the most substantial variable, necessitating improving computer-related skills and providing more technological infrastructure within their organization. For their organizational characteristics, business managers should also consider evaluating their internal readiness and the firm's core competencies in the e-commerce adoption stage. As Indian SMEs suffer from a lack of technological infrastructure and know-how, the study has the following implications:

Selection of E-commerce service provider

Owners and Managers of SMEs should be selective in choosing the appropriate e-commerce service provider equipped with all the latest and updated e-commerce technologies and willing and able to provide in-house training to the workers of SMEs.

Establishment of a separate IT department for solving technical queries

The provision of training can only familiarize the workers with the latest technologies. To fully utilize the e-commerce platform at work, IT teams need specificities and technical backups offered by IT teams to solve their day-to-day problems. To create separate IT departments for helping and answering their technical queries.

Top Management Involvement and Support*:* The managers of SMEs acknowledge the benefits of adopting e-commerce they are not actively involved in adopting e-commerce. To reap the full benefits of Ecommerce assimilation, they should be innovative to adopt and implement e-commerce.

Development of Security measures for online fraud and privacy*:* For resolving data and security, there is a need to install an online security system and safe e-payments methods to overcome online thefts.

Managerial Implications

The increase in Internet users and the government's considerable support for IT infrastructure led to the emergence of e-commerce in India. Growth of e-commerce leads to the reviewing of various e-commerce policies and initiatives, which are as follows:

Increasing awareness related to e-commerce

Lack of awareness among people about e-commerce advantages within the business

community in India will likely hinder its adoption and use. Therefore, for increasing e-commerce demand, there is a demand for awareness programs for the use and benefits of e-commerce in various organizations.

The development of an appropriate regulatory framework to support the e-commerce Findings of the study emphasize the importance of government support and its readiness for adoption and the assimilation stage. Hence the government should encourage the assimilation of e-commerce by developing various regulation which increases the trust in using online transaction in e-commerce among consumers and makes it a reliable platform to work. Furthermore, the government should provide an optimum regulatory framework to safeguard consumers' rights and help them overcome the fear of online thefts and fraud while doing online transactions by enforcing effective e-commerce laws in the country.

Set up an advisory cell at DIC.
District Industrial Centre is the lowest level point of contact for government Initiatives. Hence DIC can be used as a means of communication for providing advisory services to MSMEs to encourage the utilization of e-commerce. They are training the District Industrial Centre's employees regarding e-commerce technologies and developing a particular department of E-commerce advisory at the District level. In this case, DIC will actively provide support and advisory services to SMEs interested in adopting e-commerce.

6. CONCLUSION

The study looked at factors affecting the assimilation of e-commerce in SMEs in India. The study attempted to identify the factors affecting the assimilation of e-commerce in SMEs. The Technology Organization Environment (TOE) model was used as a theoretical framework to investigate the relationship and significant effect of various factors on the assimilation of e-commerce. Indian MSMEs are witnessing an extraordinarily dynamic and multi-faceted business scenario necessitating the adoption of e-commerce. Though MSMEs are generally laggards in technological and management capabilities, there has been a growth in the adoption of e-commerce platforms in recent times, although this adoption is lopsided.

SMEs have adopted e-commerce, but in terms of the assimilation of e-commerce, most of the SMEs are in the intermediate stage. Most SMEs have reached the third level of assimilation, viz. "**Complex Electronic Transaction"** but have not achieved stage four, "**the Integration stage**."

The likelihood of e-commerce assimilation was significantly affected by various factors; the statistical results show that technological factors were the most important predictors of e-commerce assimilation among the other factors. C**ompatibility** in a technical context is directly related to e-commerce assimilation. At the same time, **technological cost** and perceived risk are the most inversely related important factor of e-commerce

assimilation—similarly, the **strategic orientation** in an organizational context. External pressure, government support in an environmental context, and owner experience in an individual context were the most influencing factors in e-commerce assimilation in Indian SMEs.

Technological Factors are the significant contributors to the assimilation of e-commerce, as in e-commerce adoption, while Individual factors are the minor contributors to the assimilation of e-commerce.

In Organizational construct, strategic orientation plays a significant role in assimilating e-commerce at all stages. On the other hand, environmental construct external pressure is one of the dominating factors which significantly affects the assimilation of e-commerce at all levels.

Limitations

Firstly, the study included the small and medium enterprises located in the western UP and Delhi NCR, which may limit the generalization of the findings.

Second, because E-commerce is a new phenomenon in India & its related concepts and usage are somehow unfamiliar to the respondents. Thus they may have found specific questions irrelevant or difficult to understand. Third, the sample size of this research, with 384 respondents, will be one of the limitations. A higher sample size may offer more conclusive results.

The researcher could not measure the perception of surveyed Owners/CEO and managers at the time of e-commerce adoption. However, this issue was addressed by requesting them to ascertain their perception before e-commerce adoption.

The research uses data from only one key informant per firm: the CEO/Managers and owners of surveyed SMEs. At the same time, we did not assess the opinion of employees who also use e-commerce applications.

Future Research Directions

The limitations and shortcomings of this research study provided implications for future research. As E-commerce is relatively new in India, future studies should incorporate this measure after a while so that the number of managers familiar with E-commerce reaches a critical mass. Conducting sampling with more managers in different parts of India and other parts of the world; is suggested to gather more representative information about electronic commerce adoption in SMEs.

Researchers may focus on the influence of the dimension of e-commerce on the kind of goods and services. In future research, researchers examine whether the same research results hold across different enterprises and countries. In future research, researchers will work on how we can develop an e-commerce strategy that will be the most cost effective and easiest way for MSMEs worldwide.

The researcher has used the factors related to top management adoption of e-commerce in SMEs, so; we should incorporate employee and customer-related elements in

relationship with e-commerce adoption and assimilation within Indian SMEs. Therefore, a mixed approach, including qualitative and quantitative methods, can be used to get deeper insights into the scenario.

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