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Examining the role of macro and micro factors in the adoption of B2B e-commerce by small and medium enterprises SME's

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Abstract This study aims to examine the macro and micro factors that influence the adoption of B2B e-commerce among small and medium enterprises (SMEs) in Mongolia. The purpose of the study is to identify the extent to which national readiness, industry readiness, organizational readiness, and market readiness affect different levels of e-commerce adoption. A survey was conducted with 102 SMEs from diverse sectors, and the data were analyzed using SPSS 28 for descriptive and preliminary statistics, while Smart PLS-4 was employed to perform structural equation modeling. The results demonstrate that organizational readiness consistently emerges as the most significant determinant across all adoption levels, highlighting the critical role of leadership, infrastructure, and employee skills. Market readiness was found to strongly influence early adoption, suggesting that customer and supplier expectations act as powerful drivers for SMEs to adopt e-commerce solutions. Conversely, industry readiness exhibited a negative effect at the initial stages and became irrelevant at higher levels of adoption. National readiness showed no significant impact at any level, indicating that macro-level improvements in infrastructure and policies alone do not automatically translate into higher e-commerce adoption among SMEs. These findings contribute to the theoretical advancement of the Technology-Organization-Environment (TOE) framework by emphasizing firm-level and market-driven factors as stronger predictors of adoption than national or industry-level conditions. Practically, the results suggest that policymakers should prioritize programs that strengthen SMEs' internal digital capacities and market responsiveness rather than relying solely on national-level interventions. For business owners, the study underscores the importance of investing in digital infrastructure, human capital, and organizational culture to successfully integrate e-commerce practices. The findings not only provide valuable insights for Mongolia but also offer implications for other developing economies where SMEs face similar structural challenges in digital transformation.

Keywords: national readiness, industry readiness, organization readiness, adoption level

1. Introduction

The rapid growth of digital technology has revolutionized e-commerce, offering businesses new opportunities to improve efficiency and expand market reach (Bharadwaj et al., 2023). Among these advancements, B2B e-commerce has become a vital tool for SMEs to remain competitive in a marketplace (Kumar & Singh, 2022). B2B e-commerce offers significant benefits, such as expanded market reach, enhanced efficiency, cost reduction, access to new suppliers and customers, increased profitability, and a stronger competitive edge (Feng & Bala, 2019). B2B e-commerce is rapidly expanding, and researchers expect its growth to continue surpassing that of business-to-consumer (B2C) e-commerce (Sila, 2013).

However, adoption rates in developing countries remain relatively low. Mongolia, as a developing nation, has seen gradual improvements in digital infrastructure, internet access, and e-commerce adoption, making it a valuable case study for B2B e-commerce in SMEs. Mongolia's economy relies heavily on mining, agriculture, and SMEs, which constitute approximately 77% of all businesses (Asian Development Bank, 2020). According to the National Statistics Office of Mongolia, SMEs contribute around 40% of the country's GDP and play a crucial role in employment generation. The Mongolian government has implemented policies aimed at promoting digital transformation, including the E-Mongolia initiative, which seeks to digitize public services and facilitate technological advancements in the private sector (Ganbold & Gantulga, 2023). However, despite its potential and efforts, B2B e-commerce adoption in Mongolia remains limited due to significant macro and micro level barriers. This barrier includes elements both within and outside the organization that have the potential to affect its performance (Ikram et al., 2020; Munkhuu et al., 2023).

Factors such as infrastructure, legal frameworks, natural resources, financial systems, cultural norms, economic conditions, social structures, and political landscapes collectively constitute a macro environment (Adeola, 2016). Macro

factors, such as national readiness (Molla & Licker, 2020) and industry readiness (Diwan, 2024), play a critical role in shaping the environment for e-commerce adoption. Simultaneously, micro factors, including organizational readiness (Ramdani & van der Meer, 2020) and market force readiness (Molla & Licker, 2020), influence SMEs' internal capacity to leverage e-commerce effectively. The adoption of B2B e-commerce is essential for enhancing the competitiveness of SMEs in Mongolia. A critical aspect of understanding e-commerce adoption is evaluating the levels at which businesses engage with these technologies. This study draws on the four levels of e-commerce adoption (Molla & Licker, 2020). Understanding these adoption levels is important for both theory and practice. Studying e-commerce adoption helps understand how digital transformation happens in small businesses. This reveals thfe challenges and benefits at each stage. It also identifies the critical factors that allow businesses to move from basic to advanced e-commerce. Analyzing these levels is crucial for designing strategies and policies to address the specific barriers small businesses face at each stage.

Comparing Mongolia's B2B e-commerce adoption to other developing economies can provide insights into how different contextual factors influence adoption levels.

This research aims to address the influence of various readiness factors on the adoption of different levels of B2B e-commerce among SMEs in Mongolia. While prior research has primarily focused on developed economies such as the United States, Canada, and European countries, limited studies examine the determinants of B2B e-commerce adoption in Mongolia. Understanding these determinants will contribute to the broader discourse on technology adoption in developing economies.

Furthermore, by studying these e-commerce adoption levels, this research identifies the specific challenges faced by SME and highlights opportunities for effective interventions to support their growth. In addition, examining the interaction of macro and micro environmental factors at each stage helps bridge the gap between policy planning and practical implementation, and has the advantage over previous studies in that it allows solutions to be tailored to local circumstances. Therefore, the findings will help policymakers, business owners, and technology providers in understanding the key enablers and barriers to adoption. Moreover, the study will provide insights into how SMEs can leverage B2B e-commerce to enhance their business operations and competitiveness in the market. These insights not only contribute to local economic growth but also offer a framework applicable to other developing economies seeking to enhance SME competitiveness through B2B e-commerce integration.

2. Theoretical Background

The proposed research model examines the multilevel determinants of e-commerce adoption through national, industry, organizational, and market force readiness. These constructs collectively influence e-commerce adoption levels, conceptualized as progressive stages of maturity.

2.1. National readiness

National readiness encompasses macro-level factors such as governmental policies, digital infrastructure, legal frameworks, and the overall economic environment influencing e-commerce adoption. National readiness as the ability of an economy to incorporate ICT into its business operations (Bui et al., 2003). Moreover, national readiness refers to a government's ability to use ICT in public services to promote long-term development and increase participation in the socioeconomic value chains (Sheoran & Vij, 2022). Also, any nation's government should support policies for the technological development of IT infrastructure and regulations for SMEs' adoption of e-commerce (Ahmad & Siraj, 2023). Furthermore, national readiness is the government policies, regulations, initiatives, and incentives for the adoption of e-commerce that encourage the adoption of e-commerce in developing countries (Hendricks & Mwapwele, 2024). The external institutional environment significantly shapes organizational behavior, including e-commerce adoption.

2.2. Industry readiness

Industry readiness refers to the preparedness of an industry to adopt electronic commerce (e-commerce) technologies, which includes factors such as industry structures, standards, and the level of trust among industry participants. The development and competitive conditions of SMEs operating in the same industry can have a mutual impact on each other. For instance, adoption within an industry often creates spillover effects, where one organization's adoption positively influences others (Katz & Carl Shapiro, 1994).

This concept is particularly significant for SMEs, which often face challenges in e-commerce adoption due to their limited influence and resources compared to larger organizations (Kurnia & Johnston, 2003). Recent studies highlight the importance of industry readiness in facilitating e-commerce adoption among SMEs, emphasizing the role of trade partner readiness in influencing SMEs' decisions (Kurnia et al., 2015; Liu et al., 2025). The establishmesnt of industry-wide standards and the presence of coordinating bodies are crucial for aligning goals and fostering collaboration among trading partners, ensuring compatibility and mutual understanding (Kurnia & Johnston, 2003).

2.3. Organizational readiness

Organizational readiness is defined by the expanding market reach facilitated by the business's growing scope (Yuniarty et al., 2019). Similarly, Ocloo et al., (2020) highlight that an organizational readiness is a crucial factor in a company's willingness to adopt technological applications. It encompasses human, technological and financial resources that businesses implement, and integrate into their operations. However, some researchers argue that organizational factors, such as attitude, commitment, support, and motivation from management, are also crucial for successful e-commerce adoption level (Hendricks & Mwapwele, 2024). Morever, the role of top management is critical, especially in the context of e-commerce adoption (Abdulkarem & Hou, 2022). Building on these perspectives, organizational readiness examines various internal factors, including leadership support (Abdulkarem & Hou, 2022; Hendricks & Mwapwele, 2024), technological capabilities (Tan et al., 2007; Rahayu & Day, 2015), employee readiness (Molla & Licker, 2005; Tan et al., 2007), and financial resources (Ocloo et al., 2020). These elements are essential for the successful integration of new technologies within an organization.

2.4. Market force readiness

Market forces readiness refers to the extent to which a firm's customers, suppliers, and business partners adopt and utilize e-commerce. The market forces might affect a company's decisions regarding e-commerce adoption (Li & Xie, 2012). Firms may be compelled to implement e-commerce due to pressure from major clients and the requirement to synchronies with their supply chain partners (Li & Xie, 2012). This involves evaluating the numerous elements that affect how and why businesses embrace electronic markets, or e-markets (Johnson, 2010). For business organizations, there is a constant need to adapt their products, services and activities to the needs and wants of the market and consumers. Freeman (1984) states that organizations are influenced by the expectations and demands of key stakeholders, such as customers and suppliers, who often push for digital transformation. Also, e-commerce adoption is influenced by network externalities, where social dynamics within an organization play a greater role than the characteristics of the technology itself (Molla & Licker, 2005). Empirical evidence highlights that customer demand for faster, digitalized processes influence e-commerce adoption (Chen & Holsapple, 2013). A positive customer perception of technology use leads to higher adoption of e-commerce across all four levels (Abdulkarem & Hou, 2022).

2.5. E-commerce adoption levels

The growth of SMEs, the adoption of information technology, and the spread of e-commerce differ across various contexts. Since the 1990s, studies on B2B e-commerce adoption have been closely associated with the extent to which businesses integrate e-commerce (Ocloo et al., 2020). E-commerce growth models follow a sequential adoption process, where each stage builds upon and enhances the previous one (Al-Ghamdi et al., 2014). Researchers have used stage-based models to explain how organizations incorporate information technology into their operations. However, despite this sequential representation, businesses are not required to begin from the initial phase; instead, they may enter the adoption process at any stage (Al-Ghamdi et al., 2014). Previous studies have classified B2B e-commerce adoption into four levels (Hu et al., 2019; Ocloo et al., 2020; Abdulkarem & Hou, 2021). These levels align with innovation adoption and maturity models, depicting e-commerce adoption as a progressive process.

Building on the theoretical framework discussed, we present the following hypotheses:

H1: National readiness positively associated with B2B e-commerce adoption levels.
H2: Industry readiness positively associated with B2B e-commerce adoption levels.
H3: Organization readiness positively associated with B2B e-commerce adoption levels.
H4: Market force readiness positively associated with B2B e-commerce adoption levels.

2.6. Research model

As shown in Figure 1, the research model illustrates the relationships among national, industry, organizational, and market readiness factors in B2B e-commerce adoption.

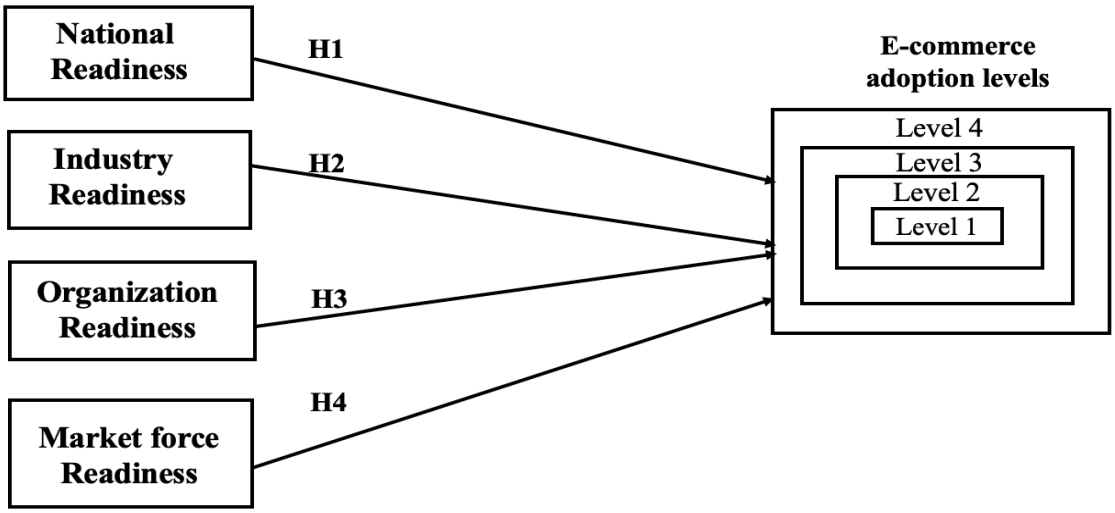

Figure 1 Research model.

3. Research Methodology

3.1. Sampling and data collection

This study employs a survey-based methodology to investigate the impact of macro-and micro-level factors on e-commerce adoption across different adoption levels.

A survey was conducted using a random sampling method, selecting 102 organizations as the sample. The selected businesses represent a diverse range of industries and operational scales, ensuring a comprehensive understanding of the factors influencing SME performance and growth. The random selection process enhances the reliability and generalizability of the findings, providing valuable insights into the broader SME landscape in Mongolia.

Mongolia has approximately 67,000 SMEs, accounting for about 67% of all registered businesses in the country www.1212.mn.

To ensure data accuracy and clarity, researchers conducted in-person visits to all participating companies. During these visits, the survey was administered directly to key decision-makers, including CEOs and managers, allowing for clarification of any questions. This approach helped enhance response reliability and ensured a deeper understanding of complex concepts, such as technological infrastructure readiness and managerial attitudes toward digital transformation. By engaging directly with respondents, the study minimized potential misinterpretations and improved the overall quality of the collected data. Table 1 presents the general information of the SMEs (n=102) that participated in this study.

Table 1 General information of SME (n=102).

Variables	Data	Number	Percentage (%)
Gender of CEO	Men	70	68.6%
	Women	32	31.4%
Size of company	Micro small	40	39.2%
	Small	30	29.4%
	Medium	32	31.4%
	Less than 5	37	36.3%
Year	6-10	23	22.5%
	11-15	30	29.4%
	16-20	12	11.8%

Above table provides an overview of the general characteristics of the 102 SMEs surveyed in this study (table 1). In terms of leadership, the majority of CEOs are men, accounting for 68.6% (70 out of 102), while women represent 31.4% (32 out of 102). Regarding company size, 39.2% of the firms (40) are classified as micro-small enterprises, 29.4% (30) fall into the small enterprise category, and 31.4% (32) are medium-sized enterprises. The table also presents data on the number of years these SMEs have been in operation. A significant proportion, 36.3% (37 firms), have been in business for less than five years, while 22.5% (23 firms) have operated for 6–10 years. Additionally, 29.4% (30 firms) have been in business for 11–15 years, and 11.8% (12 firms) have been operating for 16–20 years. These figures provide insights into the composition of the sample in terms of leadership, business size, and operational maturity.

3.2. Measurements

The survey used a five-point Likert scale, ranging from 1 to 5, to capture respondents' perceptions. For the survey instruments, the researchers designed a structured questionnaire that incorporated validated scales adapted from prior studies. This study assesses e-commerce adoption and its influencing factors across four primary dimensions: national readiness, industry readiness, organizational readiness, and market force readiness. National readiness aligns with the framework proposed by Zhu et al. (2006). Industry readiness measures are adapted from Kurnia et al. (2015). Organizational readiness indicators are informed by Tornatzky and Fleischer (1990). Market readiness measures are adapted from Freeman (1984).

B2B e-commerce adoption was assessed using fifteen electronic business processes (eBPs), which were categorized into four distinct levels of adoption. The items of e-commerce adoption level were adapted from Elbeltagi et al. (2016) and refined based on the researchers' insights and findings from a pilot study. The proposed B2B e-commerce adoption framework consists of four levels: Level 1 represents the initial stage of B2B e-commerce adoption, while Level 4 signifies the most advanced stage. This staged adoption model is based on prior literature (Ocloo et al., 2020), which examines the factors affecting e-commerce adoption among SMEs. By employing these measurement constructs, the study aims to comprehensively analyze the factors influencing e-commerce adoption levels among SMEs.

3.3. Data analysis and results

This study used partial least squares structural equation modeling through the Smart-PLS software to test the hypotheses. PLS-SEM was chosen as the most appropriate approach because it enables simultaneous statistical testing and can handle both reflective and formative constructs. PLS is a variance-based method for estimating path models with latent variables, and it has gained widespread acceptance across numerous disciplines, including information systems. The PLS-SEM approach is particularly beneficial when the research focuses on analyzing the key determinants of a specific target construct. It serves as a robust methodological alternative to covariance-based structural equation modeling when the data distribution violates the assumption of multivariate normality. Additionally, a bootstrapping method, was employed to construct confidence intervals for hypothesis testing. The primary purpose of bootstrapping is to calculate the standard error of the coefficient estimates, which allows for examining the statistical significance of the coefficients. A bootstrapping algorithm of 5000 samples was applied. PLS-SEM was deemed appropriate in this case as it does not impose strict requirements for the data to exhibit multivariate normality. Furthermore, PLS-SEM is considered suitable for examining complex cause-and-effect models and is useful for prediction purposes. Recent studies have explored the use of PLS-SEM for confirmatory purposes, and it is considered the preferred method when a structural equation model includes both factors and composites (Henseler et al., 2016). PLS-SEM's popularity stems from its ability to accommodate non-normal data, small sample sizes, and the use of formative indicators, making it a versatile tool for researchers across various fields (Hair et al., 2014).

3.4. Measurement model assessment

The reliability and validity of the measurement model were evaluated using Composite Reliability (CR), Cronbach's Alpha, and Average Variance Extracted (AVE), following established guidelines (Hair et al., 2014; Fornell & Larcker, 1981). Cronbach's Alpha was used to assess the internal consistency of the constructs, with values above 0.7 indicating satisfactory reliability (Nunnally & Bernstein, 1994). CR values, which account for indicator loadings, also exceeded the 0.7 threshold, further confirming construct reliability (Bagozzi & Youjae, 1988). To evaluate convergent validity, AVE was calculated, with values exceeding 0.5 demonstrating that the constructs explain more than 50% of the variance in their indicators (Fornell & Larcker, 1981). As presented in Table 2, all AVE values met this criterion, ensuring adequate convergent validity. Cronbach's alpha values were calculated for all survey constructs to ensure internal consistency, with values exceeding the threshold of 0.70, indicating acceptable reliability (Keith, 2018). Content validity was established through a pre-test of the survey instrument with five experts in e-commerce research and practice. Construct validity was assessed through confirmatory factor analysis (CFA), verifying the measurement model's fit (Kline, 2016) as evident in Table 2.

Table 2 shows the reliability and validity of the reflective latent variables, including Cronbach's Alpha, Composite Reliability, and Average Variance Extracted.

The measurement model for the formative latent variables was assessed using weight statistics (Hair et al., 2014). Each stage of B2B e-commerce adoption was conceptualized as a formative latent construct. To evaluate the statistical significance and relevance of each formative indicator.

As shown in Table 3, the indicator weights were substantial and statistically significant at the 0.01 level (Sarstedt et al., 2017). Additionally, all variance inflation factors (VIF) remained below the threshold of 3.3 (Petter et al., 2007), confirming the absence of collinearity concerns (Table 3). These findings indicate that the measurement model demonstrates satisfactory quality, making it suitable for structural model evaluation. Table 3 displays the formative latent variables of the measurement model with indicator weights and VIF values.

Table 2 The reflective latent variables of measurement model.

Levels	Construct	Cronbach's alpha	CR	AVE
Level 1	NR	0.713	0.614	0.648
	IR	0.873	0.930	0.769
	OR	0.900	0.905	0.657
	MR	0.794	0.880	0.713
Level 2	NR	0.713	0.902	0.648
	IR	0.873	0.803	0.658
	OR	0.900	0.881	0.714
	MR	0.794	0.930	0.769
Level 3	NR	0.713	0.661	0.648
	IR	0.873	0.681	0.658
	OR	0.900	0.930	0.714
	MR	0.794	0.881	0.769
Level 4	NR	0.713	0.669	0.533
	IR	0.873	0.811	0.653
	OR	0.900	0.663	0.703
	MR	0.794	0.806	0.713

Table 3 The formative latent variables of measurement model.

Adoption levels	Indicators	Weights	VIF
Level 1	Level 1A	0.353	1.762
	Level 1B	0.204	1.212
	Level 1C	0.329	2.912
	Level 1D	0.337	2.789
Level 2	Level 2A	0.363	1.755
	Level 2B	0.223	1.223
	Level 2C	0.312	2.344
	Level 2D	0.323	3.123
Level 3	Level 3A	0.344	1.894
	Level 3B	0.210	1.363
	Level 3C	0.308	3.309
Level 4	Level 4A	0.381	1.562
	Level 4B	0.254	1.509
	Level 4C	0.337	1.916
	Level 4D	0.293	1.561

3.5. Hypotheses testing

Structural model assessment and hypotheses testing involved examining the path coefficients, which indicate the strength and direction of the relationships between constructs (Wang & Wang, 2019), Table 4 presents the path coefficients, standard deviations, t-statistics, and p-values for the relationships between national readiness, industry readiness, organization readiness, and market readiness across four hierarchical levels. The analysis evaluates the significance and strength of these relationships in influencing the dependent variable at each level. Table 4 presents the results of the Smart PLS analysis, including path coefficients, standard deviations, t-statistics, and p-values.

3.5.1. Structural model for B2B level 1

At Level 1, organization readiness ($\beta = 0.547$, $p < 0.001$) and market readiness ($\beta = 0.396$, $p < 0.001$) exhibit significant positive effects, indicating that organizations and market conditions play a crucial role in driving the dependent variable. Conversely, industry readiness has a significant negative effect ($\beta = -0.432$, $p = 0.001$), suggesting that industry-related factors may pose challenges at this stage. National readiness does not exhibit a significant impact ($\beta = 0.074$, $p = 0.453$). Figure 2 displays the structural model results for B2B adoption at Level 1.

Table 4 Smart PLS output.

Constructs	Path coefficient	Standard deviation	T statistics	P value
Level 1				
National readiness	0.074	0.099	0.750	0.453
Industry readiness	-0.432	0.127	3.402	0.001
Organization readiness	0.547	0.068	8.095	0.000
Market readiness	0.396	0.087	4.532	0.000
Level 2				
National readiness	-0.038	0.111	0.345	0.730
Industry readiness	-0.369	0.128	2.885	0.004
Organization readiness	0.516	0.077	6.714	0.000
Market readiness	0.378	0.091	4.171	0.000
Level 3				
National readiness	-0.005	0.144	0.035	0.633
Industry readiness	0.204	0.132	1.867	0.213
Organization readiness	0.524	0.085	6.450	0.000
Market readiness	0.238	0.094	2.563	0.029
Level 4				
National readiness	0.035	0.202	0.174	0.862
Industry readiness	0.050	0.127	0.393	0.694
Organization readiness	0.326	0.252	1.295	0.195
Market readiness	0.034	0.136	0.249	0.803

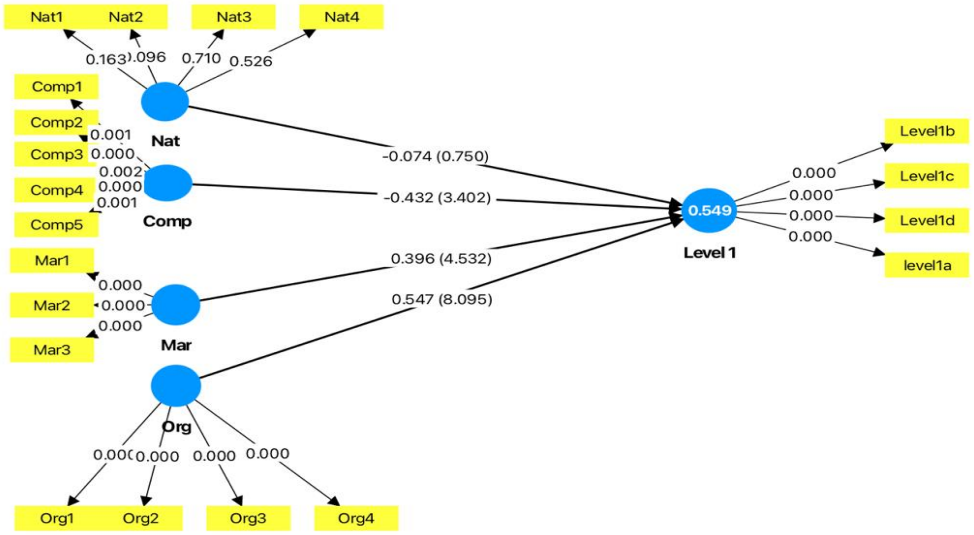

Figure 2 Smart PLS results, level 1.

3.5.2. Structural model for B2B level 2

At Level 2, similar patterns are observed. Organization readiness (β = 0.516, p < 0.001) and market readiness (β = 0.378, p < 0.001) maintain their positive significance, while industry readiness continues to have a negative influence (β = -0.369, p = 0.004). National readiness remains statistically insignificant (β = -0.038, p = 0.730). Figure 3 presents the structural model results for B2B adoption at Level 2.

3.5.3. Structural model for B2B level 3

At Level 3, organization readiness (β = 0.524, p < 0.001) continues to be a strong predictor, while market readiness (β = 0.238, p = 0.029) remains significant but with a reduced effect size. However, industry readiness is no longer statistically significant (β = 0.204, p = 0.213), indicating that its influence weakens at this stage. National readiness remains non-significant (β = -0.005, p = 0.633). Figure 4 shows the structural model results for B2B adoption at Level 3.

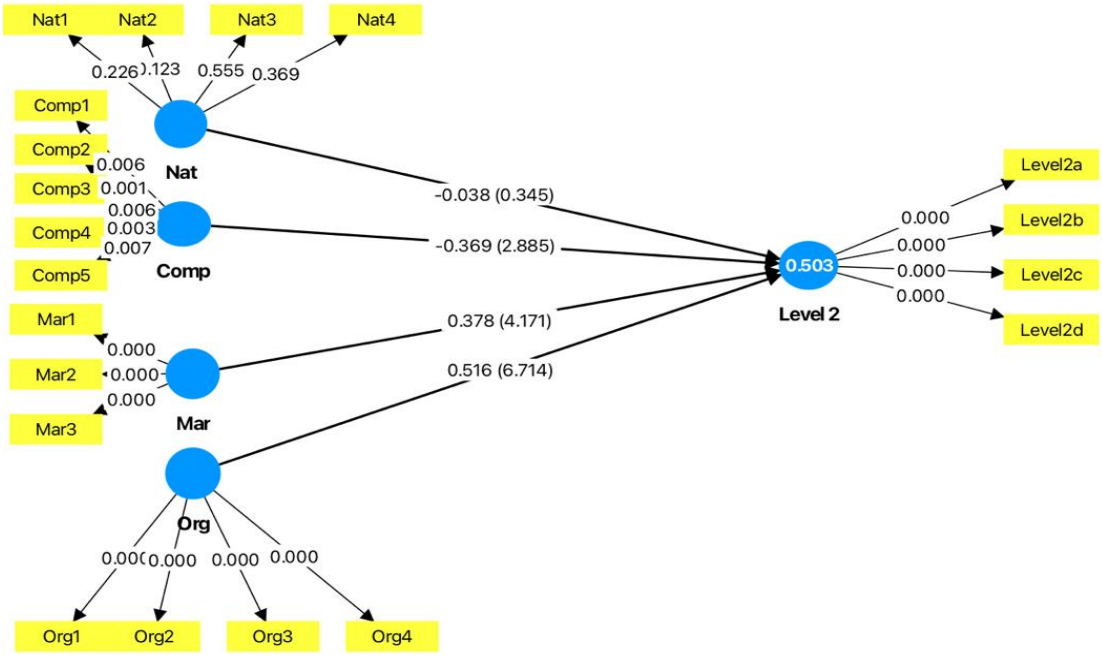

Figure 3 Smart PLS results, level 2.

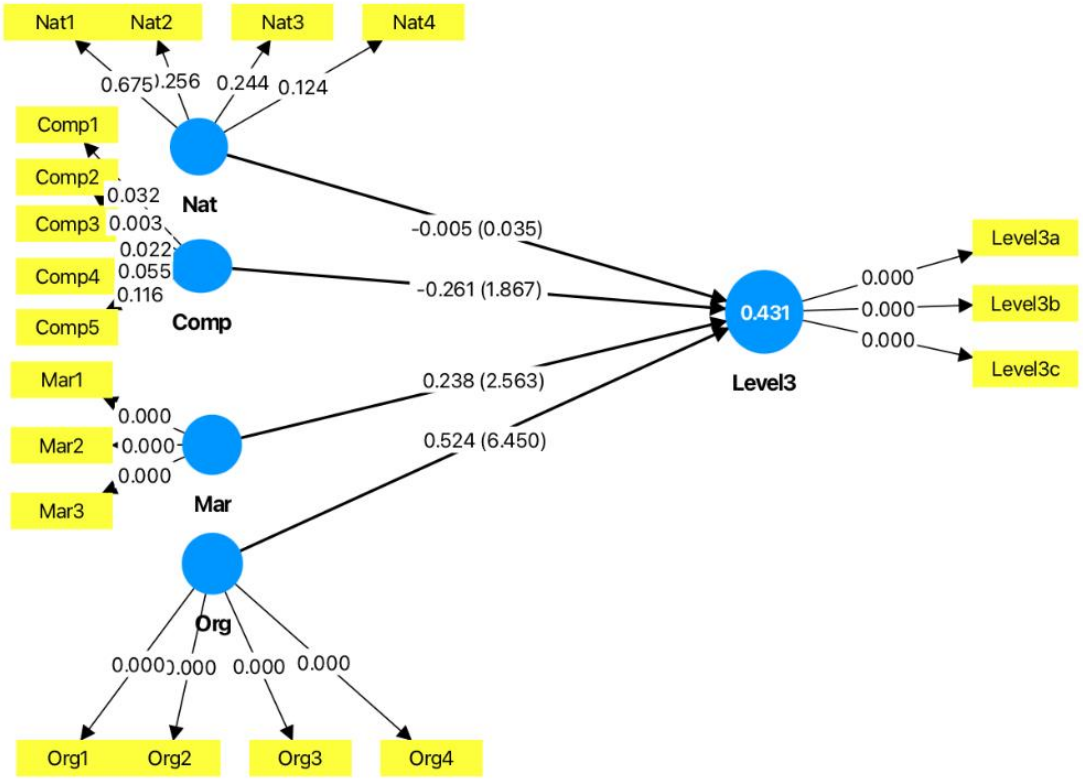

Figure 4 Smart PLS results, level 3.

3.5.4. Structural model for B2B level 4

At Level 4, none of the constructs exhibit statistical significance, suggesting that the factors influencing the dependent variable become less relevant at this stage. Organization readiness (β = 0.326, p = 0.195), market readiness (β = 0.034, p = 0.803), industry readiness (β = 0.050, p = 0.694), and national readiness (β = 0.035, p = 0.862) all demonstrate non-significant effects. Figure 5 presents the structural model results for B2B adoption at Level 4.

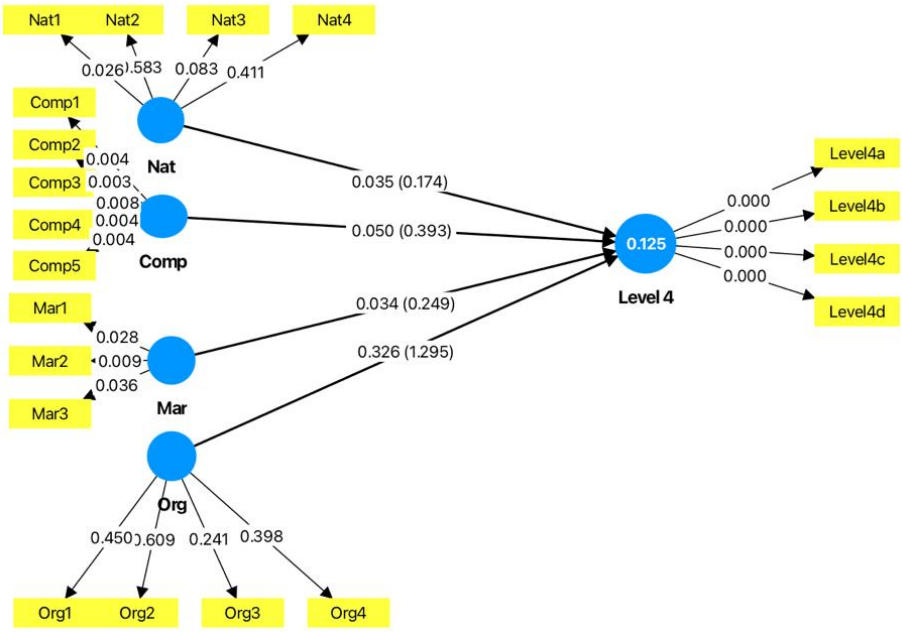

Figure 5 Smart PLS results, level 4.

4. Discussion

This study examined the roles various readiness on e-commerce adoption in B2B context. Hypothesis 1 (H1) examined the impact of national readiness on e-commerce adoption. Contrary to our expectations, the findings indicate that national readiness does not significantly influence e-commerce adoption for all 4 levels, leading to the fully rejection of Hypothesis 1. These results align with prior studies emphasizing that factors beyond national readiness, such as individual or organizational readiness, play a more significant role in driving e-commerce adoption (Smith, 2019; Lee et al., 2019). Previous research has suggested that the mere existence of infrastructure and technological advancements at the national level may not be sufficient to trigger e-commerce adoption unless paired with factors like organizational capabilities and specific market conditions (Chen et al., 2021; Prihatin et al., 2024). For Mongolia, this outcome is particularly insightful. Despite efforts to enhance the national technological and regulatory infrastructure in recent years, the lack of significant influence on e-commerce adoption indicates that these macro-level factors alone may not be enough to overcome cultural and behavioral barriers. This suggests that in the Mongolian context, other factors such as digital literacy, trust in online transactions, and local market dynamics may be more critical in determining e-commerce adoption rates (Gantulga et al., 2021). Additionally, the relatively nascent stage of e-commerce development in Mongolia could imply that adoption is still driven more by individual or business-level initiatives rather than by a top-down, national approach. These findings contribute to the understanding of e-commerce adoption in emerging markets like Mongolia, highlighting the need for a more targeted approach that considers local conditions and specific barriers to adoption rather than relying on broad national readiness indicators alone.

Hypothesis 2 (H2) posited that industry readiness would have a significant positive effect on e-commerce adoption level 1-4. However, the findings did not fully support H2, as the significant influence was only observed at levels 1 and 2 of adoption. This indicates that while industry readiness may play a role, it is not a decisive factor in determining the extent of e-commerce adoption among SMEs. The findings suggest that SMEs may depend more on their own capabilities, management perspectives, and customer needs rather than industry-wide digital preparedness when adopting e-commerce. Based on the results, we can infer that Mongolia is a small country with a small market and economy, so there is little competition. In particular, SMEs operate in clusters rather than competing with each other, which may negatively affect e-commerce adoption levels. This suggests that for Mongolian SMEs, the emphasis should be on fostering a digital culture and addressing internal readiness factors, rather than focusing solely on the industry's technological state.

The findings of this study confirm Hypothesis 3 (H3), demonstrating that organizational readiness has a significant positive effect on e-commerce adoption levels 1-3 except level 4. This result underscores the critical role of internal organizational factors such as the availability of technological resources, leadership commitment, and a skilled workforce in facilitating the successful implementation of e-commerce solutions. These findings align with previous studies, such as Ramdani & van der Meer (2018), which suggest that firms with greater technological and managerial capabilities are better positioned to integrate and leverage digital technologies. Organizations that invest in upgrading IT infrastructure, fostering a digital-first leadership mindset, and developing employees' digital competencies tend to experience smoother and more effective e-commerce adoption (Gantulga & Ganbold, 2022; Fahmi, 2023). Moreover, the significance of organizational readiness

highlights the necessity for SMEs to proactively enhance their internal capabilities before embarking on digital transformation initiatives.

Lastly, the findings partially supported hypothesis 4 (H4), indicating that market force readiness significantly influences e-commerce adoption levels 1 to 3 out of the four identified adoption levels. This suggests that customer demand and industry trends play a crucial role in driving SMEs toward adopting e-commerce. Market dynamics, including customer demand for digital services and emerging market trends, play a key role in encouraging SMEs to adopt e-commerce. These findings resonate with previous studies that highlight the importance of market conditions in driving innovation adoption (Ramdani & van der Meer, 2018). In Mongolia, as customer expectations shift towards digital transactions and global supply chains increasingly rely on e-commerce platforms, SMEs are compelled to adapt to maintain their relevance and competitiveness.

In conclusion, organization readiness is consistently the most influential factor across all levels. Market readiness also plays a key role, particularly in the earlier adoption levels. Industry readiness, while initially having a negative impact, loses significance as the levels progress, indicating that industry-related barriers may be more relevant in the early stages. National readiness does not have a significant effect at any level, implying that macro-level national factors may not be direct determinants within the scope of this study.

5. Conclusion

The findings provide critical insights into the dynamic relationships among national, industry, organizational, and market factors in shaping e-commerce adoption among SMEs. The research provides theoretical implications. First of all, the rejection of H1 and H2 suggests that while national infrastructure and industry-wide technological preparedness are important, they are not sufficient determinants of e-commerce adoption (Smith, 2019; Lee et al., 2019). These findings align with prior research indicating that firm-level capabilities and market-driven forces often play a more significant role in shaping adoption behaviors (Chen et al., 2021; Kumar & Singh, 2022). Second, the confirmation of H3 and H4 reinforces the Technology-Organization-Environment (TOE) framework by emphasizing the importance of internal organizational readiness and market pressures in driving technology adoption (Ramdani & van der Meer, 2018; Zhu et al., 2006). Specifically, firms with strong leadership support, technological infrastructure, and skilled employees are more likely to integrate e-commerce adoption successfully. Likewise, growing customer demand, supplier influence, and competitive pressures serve as motivators for SMEs to embrace digital transformation. Therefore, the current study extends prior research by demonstrating how these factors manifest in the Mongolian context, an emerging market with unique digitalization challenges.

The research also provides practical implications. National and industry-level initiatives alone are insufficient to drive e-commerce adoption in B2B SMEs. Policymakers should shift their focus towards fostering firm-level digital capabilities, such as providing financial support for SME digital transformation, enhancing digital literacy programs, and incentivizing leadership engagement in technological innovation. For business practitioners, the results emphasize the need for internal strategic investments in digital infrastructure, employee training, and leadership commitment to ensure successful e-commerce adoption. Given that market forces significantly influence adoption decisions, SMEs should closely monitor evolving customer preferences, supplier requirements, and competitive trends to remain agile in the digital marketplace.

In the Mongolian context, the findings highlight the importance of addressing trust issues in online transactions, cultural resistance to digital transformation, and limited managerial expertise in e-commerce. Government agencies, industry associations, and financial institutions should collaborate to create targeted interventions that enhance SMEs' confidence in digital adoption.

5.1. Limitations

Although the study has made some important findings, it also has a few drawbacks. First, it focuses on Mongolia, which may limit the generalizability of the findings to other emerging economies. Future research could explore comparative studies across multiple developing markets to assess whether similar trends exist. Second, this study primarily examines direct relationships; future research should investigate potential mediating and control variables, such as firm size, digital experience, and regulatory policies. Last but not least, the sample size was a significant limitation, and we were unable to distribute the questionnaires to the same number of small and medium enterprisers, which hindered the ability to make meaningful comparisons between SMEs at different adoption levels.

Ethical Considerations

This research involving human participants was conducted in accordance with established ethical standards. Informed consent was obtained from all participants prior to data collection, and their responses were treated with confidentiality and anonymity. The study followed ethical guidelines consistent with the Declaration of Helsinki.

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Conflict of Interest

The authors declare no conflicts of interest.

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