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Factors Influencing Knowledge Absorptive Capacity in E-commerce Enterprises: An Empirical Study in Vietnam

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Abstract
This study examines the factors influencing the knowledge absorptive capacity (ACAP) of e-commerce enterprises in Vietnam. Through a quantitative approach using survey data from 463 respondents working in the industry, we employ the Partial Least Squares Structural Equation Modeling (PLS-SEM) method to analyze key determinants. The findings reveal that Accumulated Knowledge (AK), Combinative Capabilities (CC), Employee Learning Capability (ELC), Knowledge Management Process (KMP), Corporate Culture (CCL), and Knowledge Networks (KN) significantly enhance ACAP. However, industry competition (IC) is found to moderate these relationships, reducing the impact of individual learning on overall absorptive capacity. These insights provide implications for both practitioners and policymakers in optimizing knowledge management strategies within the dynamic e-commerce landscape. Future research directions and limitations are also discussed.

Keywords: Knowledge absorptive capacity, Industry competition, PLS-SEM, E-commerce

1. Introduction

In the setting of a swiftly growing online commercial industry, e-commerce has become a highly competitive and dynamic sector. E-commerce companies encounter constantly evolving customer needs and must incessantly innovate to sustain a competitive advantage (Anastasiei et al., 2024). In this context, absorptive capacity (ACAP) has emerged as a vital strategic element that allows enterprises to acquire, transform, and utilize external knowledge in their internal operations (Cohen & Levinthal, 1990; Zahra & George, 2002). ACAP promotes company processes and improves innovation capacity and adaptation to market volatility (Lane et al., 2006; Flatten et al., 2011; Dospinescu & Dospinescu, 2018).

Zahra & George (2002) delineate four essential components of ACAP: Acquisition, Assimilation, Transformation, and Exploitation. Acquisition denotes a firm's capacity to identify and obtain new external knowledge; Assimilation entails the analysis and comprehension of the acquired knowledge; Transformation integrates new knowledge with existing knowledge to produce innovative insights; and Exploitation involves leveraging this knowledge to generate new value(Dospinescu & Dospinescu, 2018). These notions underscore the crucial role of ACAP

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in enhancing the performance and efficacy of enterprises within the e-commerce sector, particularly in a fiercely competitive landscape.

Notwithstanding the essential function of ACAP, scholarly investigation on this capability within the e-commerce sector is still scarce. This is especially relevant concerning the influence of internal factors such as Accumulated Knowledge (AK) **(**Schweisfurth & Raasch, 2018**)**, Combinative Capabilities (CC) **(**Chu et al., 2023**)**, Employee Learning Capability (ELC) (Fosfuri & Tribó, 2008), Knowledge Management Process (KMP) (Sabherwal & Jeyaraj, 2015), Corporate Culture (CCL), and Knowledge Networks (KN) (Lane et al., 2001; Escribano et al., 2009). These elements are essential for the development and enhancement of a firm's ACAP; yet, they have not been extensively investigated in the realm of e-commerce (Jiménez-Barrionuevo et al., 2011).

Furthermore, industry competition (IC) is an additional element that may influence the correlation between these internal characteristics and a firm's ACAP. In a competitive business landscape, companies may be increasingly driven to improve their absorptive capacity to adapt to market fluctuations rapidly (Vega-Jurado et al., 2008; Chang et al., 2012). The moderating role of IC in the e-commerce context remains inadequately explored, especially in Vietnam, where the e-commerce business is quickly evolving and marked by intense competition (Dang et al., 2022).

This study aims to address the following research questions: **Q1**: What are the internal factors affecting ACAP of enterprises in the e-commerce sector? **Q2**: How is the relationship between these internal factors and ACAP affected in the competitive environment of the industry? **Q3**: Is there a significant difference in the impact of internal factors on ACAP between enterprises of different sizes?

By answering the above research questions, this paper seeks to investigate how factors such as accumulated knowledge, combinatory capabilities, employee learning capabilities, knowledge management processes, corporate culture, and knowledge networks influence the ACAP of e-commerce firms, as well as how industry competitiveness moderates these linkages, and finally to explore the extent to which the impact differs across firms of different sizes in the industry.

The research employs partial least squares structural equation modeling (PLS-SEM) to evaluate the hypotheses and examine the linkages within the model. The paper is organized as follows: the initial section offers a literature review on ACAP and its influencing factors; the subsequent section outlines the research methodology, encompassing research design, sample, and data analysis techniques; the next segment presents the results of data analysis and hypothesis testing; the discussion section interprets the primary findings and contrasts them with prior studies; and ultimately, the paper concludes with theoretical contributions, practical implications, and recommendations for future research.

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2. Literature review, hypothesis development, and research model

2.1. Knowledge absorptive capacity (ACAP)

Knowledge absorptive capacity (ACAP), as defined by Cohen & Levinthal (1990), refers to an organization's capability to identify, assimilate, and utilize fresh external information for commercial objectives. ACAP is considered a vital catalyst for innovation, enabling enterprises to adjust to environmental shifts and utilize new knowledge to improve competitiveness (Zahra & George, 2002). By cultivating a robust ACAP, enterprises may proficiently acquire and utilize knowledge from external sources, hence enhancing organizational processes, goods, and services (Lane et al., 2006; Strese et al., 2016).

Zahra & George (2002) delineate four elements of ACAP: Acquisition, Assimilation, Transformation, and Exploitation. Acquisition denotes a company's capacity to recognize and obtain significant external knowledge. Assimilation entails the integration and comprehension of new knowledge, aligning it with the pre-existing knowledge frameworks inside the organization. Transformation is the process by which organizations integrate acquired information with current capabilities to produce new insights or skills. Ultimately, exploitation denotes the organization's ability to utilize the newly assimilated information in its activities to generate value (J. J. Jansen et al., 2005; Flatten et al., 2011).

ACAP is especially pertinent in the e-commerce sector owing to the swift technological advancements and competitive dynamics that define the industry. Organizations possessing elevated absorptive capacity may swiftly implement advancements in information technology, data analytics, and customer relationship management, which are essential for success in e-commerce (Dang et al., 2022). Additionally, ACAP facilitates enterprises in acquiring knowledge from competitors and industry collaborators, hence expediting the implementation of best practices and creative solutions (Jiménez-Barrionuevo et al., 2011).

2.2. Factors affecting ACAP

2.2.1. Accumulated knowledge (AK)

Accumulated knowledge is considered an essential factor affecting enterprises' ACAP. A study by J. J. Jansen et al. (2005) in the Netherlands showed that accumulated knowledge has a significant impact on the ability of enterprises to absorb new knowledge using quantitative methods and data analysis from 283 business units. Similarly, a study by Chu et al. (2023) in Vietnam also emphasized the role of accumulated knowledge in improving ACAP and innovation of seafood processing enterprises. A study by Zahra & George (2002) confirmed that accumulated knowledge helps enterprises identify, absorb, and effectively apply new knowledge. Although the context, subjects, and time of research are different, the research results of the authors Escribano et al. (2009)), Schweisfurth & Raasch (2018), Duy (2020) are similar to the above studies. Based on the research overview and the results of previous studies, the researcher proposes the following hypothesis:

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Hypothesis H1*: AK has a positive impact on ACAP of enterprises in the e-commerce sector in Vietnam.*

2.2.2. Combinative Capabilities (CC*)*

Knowledge combining capability allows enterprises to link and combine knowledge from different sources to create new value. Research by Chu et al. (2023) confirmed that knowledge combining capability has a positive impact on ACAP and the business performance of seafood enterprises in the Mekong Delta. Zahra & George (2002) also emphasized the role of combining capability in enhancing the ability to absorb and apply new knowledge. They pointed out that the ability to combine knowledge from internal and external sources is a decisive factor in helping enterprises enhance their innovation and creativity. This research confirmed that combining knowledge not only helps enterprises effectively absorb new knowledge but also helps them apply this knowledge to business practices. Research by Bosch et al. (1999) also emphasized that knowledge-combining capability plays a vital role in developing the ACAP of enterprises. They argue that enterprises that are able to combine knowledge from different sources will have an advantage in seizing new business opportunities and adapting quickly to changes in the business environment. J. J. Jansen et al. (2005) pointed out that knowledge combination capability is an essential factor that helps enterprises improve ACAP. This study used the structural equation modeling method (SEM), and the results showed that enterprises that can combine knowledge from different sources are able to assimilate and exploit new knowledge more effectively. Flatten et al. (2011) developed the ACAP scale and confirmed that knowledge combination capability is one of the crucial factors contributing to the ability of enterprises to receive and apply new knowledge. Based on the research overview and the results of previous studies, the researcher proposes the following hypothesis:

Hypothesis H2: *CC has a positive impact on ACAP of enterprises in the E-commerce sector in Vietnam.*

2.2.3. Employee Learning Capability (ELC)

Employee learning capability is an essential factor in helping businesses absorb and apply new knowledge. Learning capability not only helps employees improve their individual skills but also contributes to improving the ACAP of the entire business (DOSPINESCU & Florea, 2016). Cohen & Levinthal (1990) emphasized that employees with high learning capabilities will help enterprises quickly grasp and implement new knowledge into business operations, thereby improving performance and competitiveness. Liao et al. (2008) also pointed out that ELC has a positive impact on ACAP, helping businesses enhance their innovation and improve performance. According to Liao et al. (2008), businesses with employees with high learning capability often achieve success in absorbing and applying new knowledge. Kim (2009) study on the development of learning in organizations emphasized that encouraging continuous learning and innovation in daily activities will help enhance ACAP. Kim (2009) argues that organizations need to create a flexible learning environment where employees can easily exchange and share knowledge. In addition, Marsick & Watkins (2003) developed a theoretical framework for

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learning organizations, asserting that continuous learning organizations help employees develop skills but also improve the organization's ability to absorb and apply knowledge. According to Marsick & Watkins (2003), employee training and development programs, along with learning culture, will create a solid foundation for improving ACAP. Jerez-Gomez et al. (2005) also emphasized the importance of learning capabilities for ACAP. They found that organizations that encourage learning and innovation are more likely to absorb and apply new knowledge effectively. Bierly & Daly (2002) argue that businesses with a strong and supportive learning environment will have a better ability to absorb knowledge. According to Bierly & Daly (2002), investing in developing employees' learning skills is an important strategy to improve ACAP. Based on the research overview and the results of previous studies, the researcher proposes the following hypothesis:

Hypothesis H3*: ELC has a positive impact on ACAP of enterprises in the E-commerce sector in Vietnam.*

2.2.4. Knowledge Management Process (KMP)

Knowledge management processes include activities such as creating, sharing, and applying knowledge to business practices (Gold et al., 2001). According to the research results of Gold et al. (2001) in the US, effective knowledge management processes can improve the ability to receive and apply new knowledge. Knowledge management processes such as knowledge storage, knowledge sharing, and knowledge application have a positive impact on ACAP (Gold et al., 2001). Research by Liao et al. (2008) also emphasized that knowledge management processes are an essential factor in helping businesses improve their ability to absorb knowledge and improve operational performance. According to Liao et al. (2008), businesses with good knowledge management processes will be able to learn and innovate more effectively. This is demonstrated through an improved ability to receive and apply knowledge to daily activities. Alavi & Leidner (2001) found that information technologies that support knowledge management processes play an essential role in enhancing ACAP. According to Alavi & Leidner (2001), knowledge management systems help organizations store and retrieve knowledge effectively, thereby facilitating learning and sharing of knowledge. In addition, Nonaka (2009) found that knowledge creation, knowledge sharing, and knowledge application processes can enhance a firm’s ability to innovate. Accordingly, the creation of new knowledge through processes such as employee training and learning from experience is an essential factor in helping a firm maintain its competitiveness (Nonaka, 2009). Choi & Lee (2003) found that firms with good knowledge management processes tend to have higher performance. Knowledge management processes not only help businesses acquire new knowledge but also support the application of knowledge into business processes, thereby improving performance and labor productivity (Choi & Lee, 2003). Furthermore, the study of Davenport & Prusak (1998) emphasized that businesses need to have a clear knowledge management strategy and support systems to ensure that knowledge is shared and applied effectively. Based on the research overview and the results of previous studies, the researcher proposes the following hypothesis:

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Hypothesis H4*: KMP has a positive impact on ACAP of enterprises in the E-commerce sector in Vietnam.*

2.2.5. Corporate Culture (CCL)

Corporate culture is an essential factor that affects the ability of an enterprise to receive and apply new knowledge. A corporate culture that encourages learning, creativity, and knowledge sharing can create a favorable environment for improving ACAP. Research by Zahra & George (2002) has confirmed that a corporate culture that supports learning and innovation will help improve ACAP. Accordingly, enterprises with a culture that encourages innovation and learning are often able to absorb and apply new knowledge more effectively (Zahra & George, 2002). An open corporate culture that supports learning from failure has also been identified as an essential factor in improving this capacity (Zahra & George, 2002). Research results by Flatten et al. (2011) indicate that corporate culture can influence the elements that makeup ACAP, thereby improving this capacity. Organizations with a culture that supports knowledge sharing and encourages collaboration among employees are better able to absorb and exploit new knowledge (Flatten et al., 2011). An open organizational culture, where new ideas are welcomed and encouraged, enhances the organization's ability to absorb knowledge (Flatten et al., 2011). Research by Liao et al. (2008) shows that an organizational culture that encourages learning and knowledge sharing has a positive impact on ACAP. Organizations with a strong knowledge sharing culture are more likely to absorb new knowledge quickly and effectively (Liao et al., 2008).

In addition, research by Janz & Prasarnphanich (2003) has explored and found that organizations with a culture that supports learning and knowledge sharing often have a higher success rate in knowledge management projects. This suggests that corporate culture not only affects ACAP but also impacts the performance of knowledge-related projects (Janz & Prasarnphanich, 2003). In line with this view, Quinn (2011) also emphasized that businesses with flexible cultures, where creativity and experimentation are encouraged, will have a better ability to absorb new knowledge. Based on the research overview and the results of previous studies, the researcher proposes the following hypothesis:

Hypothesis H5*: CCL has a positive impact on ACAP of enterprises in the E-commerce sector in Vietnam.*

2.2.6. Knowledge Networks (KN)

Knowledge networks help firms access and share knowledge effectively, thereby improving ACAP. Tsai (2001) found that firms with a good position in knowledge networks are more effective in acquiring and transferring internal knowledge, thereby improving ACAP and innovation performance. Specifically, this study found that knowledge networks create opportunities for information exchange and collaboration, which helps firms quickly grasp and apply new knowledge. Liao et al. (2008) also emphasized that knowledge networks play an essential role in enhancing the ability to absorb and apply new knowledge. This study found that

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frequent interactions among network members help maintain knowledge flows and improve firms' learning capabilities. The results of the study showed that firms with strong knowledge networks tend to perform better when applying new knowledge to business processes. A study by Reagans & McEvily (2003) explored the impact of knowledge networks on knowledge transfer within organizations. Accordingly, the level of connectivity of a firm in the network has a great effect on its ability to receive knowledge from outside (Reagans & McEvily, 2003). Firms with extensive and diverse knowledge networks have the ability to access many different sources of knowledge, thereby improving ACAP. Another study by Inkpen & Tsang (2005) also found that knowledge networks not only facilitate knowledge reception but also help firms integrate and apply knowledge into practice. Further, a study by Nahapiet & Ghoshal (1998) also determined that social and knowledge networks within organizations play an essential role in creating and sharing knowledge. Firms with strong social networks are able to create new knowledge through social interactions and learning from external partners, thereby helping to improve the ACAP and innovation capabilities of the firm (Nahapiet & Ghoshal, 1998). Based on the research overview and the results of previous studies, the researcher proposes the following hypothesis:

Hypothesis H6: *KN has a positive impact on ACAP of enterprises in the E-commerce sector in Vietnam.*

2.3. Industry competition as a moderator

The level of competition in the industry can put pressure on firms to improve ACAP. When industry competition increases, firms are forced to search and apply new knowledge more quickly and effectively to maintain and improve competitiveness. Tsai (2001) analyzed the role of knowledge networks and Industry competition on ACAP in Taiwan. The results showed that high competition motivates firms to improve ACAP to improve performance and enhance competitiveness. Tsai (2001) asserted that competition in the industry is an essential driving force for firms to improve their learning and innovation capabilities. Porter & Strategy (1980) also emphasized that the level of competition in the industry can influence firm strategy and behavior. Firms in highly competitive environments often face pressure to continuously innovate and improve their knowledge management capabilities to maintain their competitive advantage (Nguyen et al., 2021). Similarly, Hitt et al. (1997) found that firms operating in highly competitive industries tend to have higher performance, as they must continuously improve their learning and innovation capabilities to maintain their competitive position. Zahra & George (2002) study also showed that industry competition affects the firm's ability to absorb knowledge. Firms operating in highly competitive industries tend to invest more in R&D and knowledge management activities to maintain and improve their competitiveness (Zahra & George, 2002). In addition, a study by J. J. Jansen et al. (2005) confirmed that the level of competition in the industry is an essential factor affecting ACAP. Competition creates pressure for innovation and learning, which in turn motivates firms to improve their knowledge absorption capacity (J. J. Jansen et al., 2005). Based on the research overview and the results of previous studies, the researcher proposes the following hypotheses:

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Hypothesis H7.1*: IC moderates the relationship between AK and ACAP of enterprises in the E-commerce sector in Vietnam*
Hypothesis H7.2*: IC moderates the relationship between CC and ACAP of enterprises in the E-commerce sector in Vietnam*
Hypothesis H7.3*: IC moderates the relationship between ELC and ACAP of enterprises in the E-commerce sector in Vietnam*
Hypothesis H7.4*: IC moderates the relationship between KMP and ACAP of enterprises in the E-commerce sector in Vietnam*
Hypothesis H7.5*: IC moderates the relationship between CCL and ACAP of enterprises in the E-commerce sector in Vietnam*
Hypothesis H7.6*: IC moderates the relationship between KN and ACAP of enterprises in the E-commerce sector in Vietnam*

2.4. Research Model

This study's research model delineates the relationships among critical internal factors: Accumulated Knowledge (AK), Combinative Capabilities (CC), Employee Learning Capability (ELC), Knowledge Management Process (KMP), Corporate Culture (CCL), Knowledge Networks (KN), and Absorptive Capacity (ACAP) within e-commerce firms. The model examines the moderating effect of industry competition (IC) on these relationships, positing that increased competition amplifies the influence of each internal factor on ACAP.

The primary hypotheses (**H1** to **H6**) indicate a direct correlation between internal factors and absorptive capacity (ACAP), suggesting that aspects such as absorptive knowledge (AK), collaborative capabilities (CC), external learning capabilities (ELC), knowledge management practices (KMP), collaborative culture (CCL), knowledge networks (KN), and a flexible organizational structure contribute positively to a firm's absorptive capacity. The moderation hypotheses (**H7.1** to **H7.6**) suggest that competitive intensity within the industry enhances these relationships, prompting firms to optimize the use of their internal resources in reaction to market pressures.

The figure below illustrates the conceptual research model, outlining the hypothesized relationships among internal factors, absorptive capacity, and the moderating effect of industry competition.

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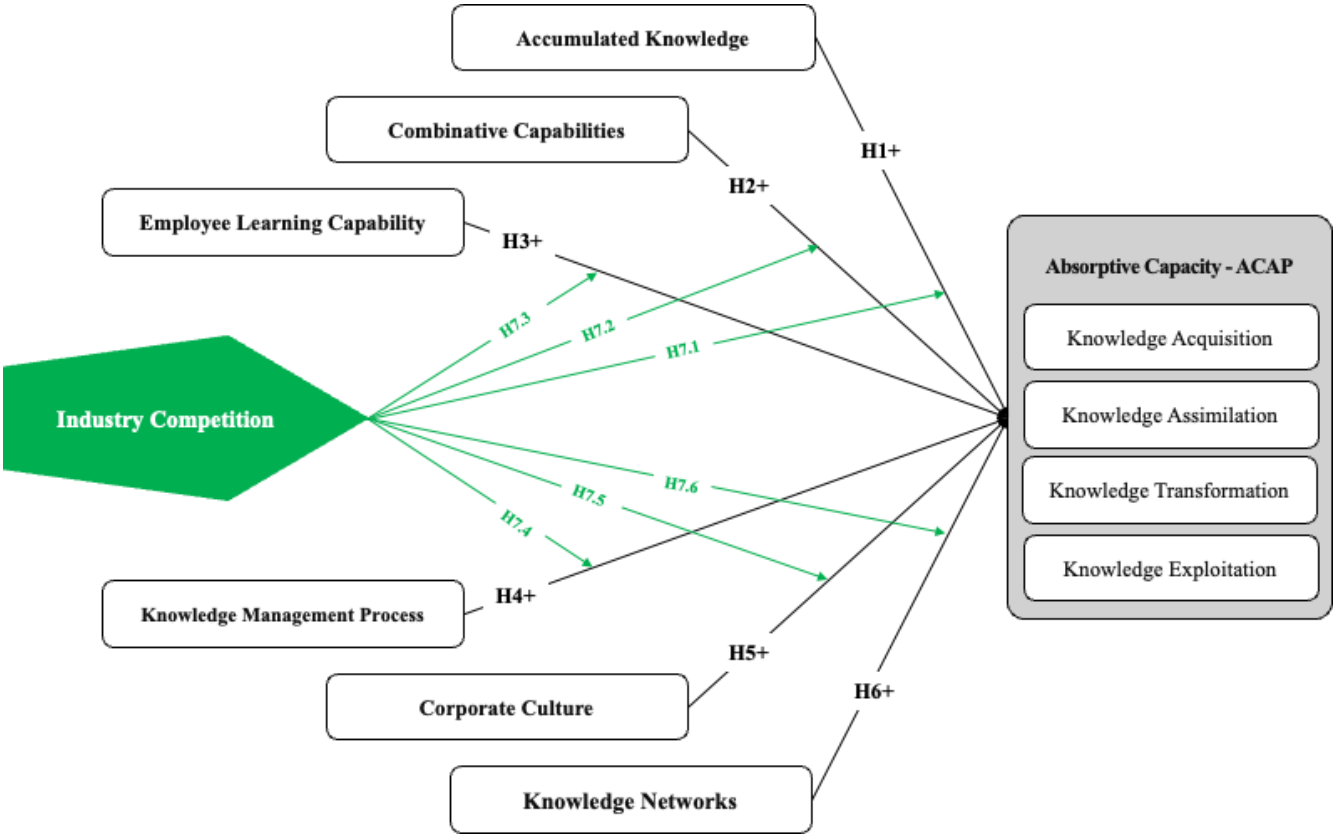

Figure 1: Research model

3. Methodology

3.1. Research Design

With a quantitative approach, this study investigates how e-commerce firms' internal factors—including Accumulated knowledge, Combinative capabilities, Employee learning capability, Knowledge management process, Corporate culture, and Knowledge networks—relate to their ACAP and how industry competition (IC) acts as a moderator. The data from a sample of e-commerce enterprises was collected at a particular moment in time using a cross-sectional survey approach. Finding correlations and hypothesis testing in a constantly changing business setting are both made easier using this method (Hair Jr et al., 2021).

The information was mostly analyzed using partial least squares structural equation modeling, often known as PLS-SEM. PLS-SEM's resilience with smaller sample sizes, adaptability for exploratory research, and capacity to handle complicated models with many associations make it an ideal fit for this study (Hair Jr et al., 2021). To fully grasp the study model, this approach is perfect for investigating the moderating effect of industry competition as well as the direct effects of internal factors on ACAP.

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3.2. Data Collection

To collect data for this study, the author conducted an online survey using the Google Form tool, sending the survey link to the network of e-commerce companies during the period from June 2024 to December 2024. The subjects participating in answering the survey were managers of companies operating in the e-commerce sector in Vietnam. The target of the online survey was **600** questionnaires. During the survey, all variables such as Absorptive capacity, Accumulated knowledge, Combinative capabilities, Employee learning capability, Knowledge management process, corporate culture, Knowledge networks, and Industry competition were all assessed according to the survey items. To ensure the accuracy of participant responses, the author encrypted and secured all questionnaires. The results obtained **463** valid responses, reaching a rate of **77.1%.** The author has a strong data set to evaluate his research hypotheses using PLS-SEM.

3.3. Measurement scales

The measurement scales employed in this investigation were predominantly sourced and modified from existing literature to guarantee reliability and validity. Each dimension was assessed utilizing multi-item Likert scales, with response possibilities spanning from 1 (strongly disagree) to 5 (strongly agree). The accumulated knowledge was derived from the studies of Cohen & Levinthal (1990) and Lane et al. (2006), emphasizing the organization's capacity to identify and integrate pertinent knowledge. The evaluative criteria for combinative capabilities were predicated on the capacity to integrate knowledge from both internal and external sources (Bosch et al., 1999; J. J. Jansen et al., 2005; Chu et al., 2023). The measurement of employee learning capability utilized items developed by Marsick & Watkins (2003) and Liao et al. (2008). The knowledge management process scale was derived from the works of (Choi & Lee, 2003; Liao et al., 2008) (Nonaka, 2009). Corporate culture was assessed using items derived from the studies of Flatten et al. (2011) and Quinn (2011). Knowledge networks were derived from the research of Liao et al. (2008) and Reagans & McEvily (2003). Absorptive capacity was evaluated using the multi-dimensional model established by Zahra & George (2002), which encompasses acquisition, assimilation, transformation, and exploitation processes. Industry rivalry was evaluated using items derived from Porter & Strategy (1980) and J. J. P. Jansen et al. (2005), focussing on the perceived intensity of competition within the industry.

It was ensured that all of the elements were translated and changed to meet the context of Vietnamese e-commerce, which ensured that participants would have clarity and relevance. As part of the PLS-SEM analysis, the scales were subjected to additional testing to determine their reliability and validity.

3.4. Data Analysis

Using a technique that works well for investigating complicated interactions and exploratory studies with medium-sized samples, the data was analyzed using partial least squares structural equation modeling (PLS-SEM). There were primarily three steps to the analysis: (1) Evaluation of measurement models: checked for concept validity and reliability by measuring discriminant

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validity, convergent validity, and composite reliability. (2) Evaluating the structural model: Verified the predicted correlations by checking the importance of the path coefficients to assess the model's direct effects. The third method is multi-group analysis (MGA), which compares path coefficients across groups with varying degrees of competitive intensity in order to learn how industry competition acts as a moderator.

4. Results

4.1. Measurement model evaluation

The author evaluated the measurement model to assess the reliability and validity of the constructs using several criteria, including internal consistency reliability, convergent validity, and discriminant validity, as presented in Table 1 and Table 2. This evaluation confirms that each construct accurately represents the theoretical constructions and that they are adequately distinct from one another.

The reliability of each construct was initially validated by high outer loadings on its items, demonstrating robust representation by the measurement indicators. The observed variables with indicator coefficients less than 0.8 are ELC7 (0.69), ELC8 (0.65), and KMP9 (0.65). The reliability of these variables is not guaranteed (Sarstedt et al., 2021). The author excluded these variables from the research model. The findings from the second PLS-SEM analysis indicated that all indicators of the model's variables exceeded the threshold of 0.8 (refer to Table 1). The outer loadings for AK range from 0.86 to 0.89, whereas for CC, they range from 0.86 to 0.88, thus satisfying the criteria for item reliability (Hair et al., 2019). Internal consistency was additionally evidenced by Cronbach's alpha and Composite Reliability (CR (rho_c)) values, all of which surpassed the 0.7 threshold. ACAP demonstrates a Cronbach's alpha of 0.96 and a composite reliability (CR) of 0.97, indicating strong internal consistency (refer to Table 1).

Convergent validity was demonstrated by average variance extracted (AVE) values exceeding the 0.5 threshold for all constructs, indicating that each construct adequately captures variance from its items (Fornell & Larcker, 1981). The Knowledge networks construct has an AVE of 0.74, indicating that over 50% of its variance is accounted for by its items (refer to Table 1).

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Table 1. Assessment of measurement model

Construct	Reliability & Validity			Items	VIF	Outer loading							
	Alpha	CR (rho_c)	AVE			AK	CC	ELC	KMP	CCL	KN	IC	ACAP
Accumulated Knowledge	0.92	0.94	0.76	AK1	3.10	0.89							
				AK2	2.50	0.86							
				AK3	2.60	0.87							
				AK4	2.83	0.88							
				AK5	2.68	0.86							
Combinative Capabilities	0.92	0.94	0.76	CC1	2.67		0.87						
				CC2	2.75		0.87						
				CC3	2.79		0.88						
				CC4	2.89		0.88						
				CC5	2.61		0.86						
Employee Learning Capability	0.93	0.94	0.67	ELC1	2.88			0.85					
				ELC2	2.94			0.86					
				ELC3	2.97			0.86					
				ELC4	2.83			0.85					
				ELC5	2.98			0.86					
				ELC6	2.93			0.86					
				ELC7 *	1.70			0.69					
				ELC8	1.6			0.6					

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				*	1			5					
Knowledge Management Process	0.94	0.95	0.69	KMP1	2.75				0.84				
				KMP2	2.80				0.85				
				KMP3	2.77				0.84				
				KMP4	2.85				0.85				
				KMP5	2.96				0.86				
				KMP6	3.05				0.86				
				KMP7	3.05				0.86				
				KMP8	2.92				0.85				
				KMP9 *	1.55				0.65				
Corporate Culture	0.91	0.93	0.74	CCL1	2.63					0.87			
				CCL2	2.54					0.86			
				CCL3	2.03					0.81			
				CCL4	2.78					0.87			
				CCL5	2.71					0.87			
Knowledge Networks	0.94	0.95	0.74	KN1	3.04						0.87		
				KN2	2.79						0.86		
				KN3	2.86						0.86		
				KN4	2.85						0.86		
				KN5	2.94						0.87		
				KN6	2.66						0.85		
				KN7	2.7						0.8		

					8						6		
Industry Competition	0.90	0.93	0.72	IC1	2.57							0.82	
				IC2	2.25							0.84	
				IC3	2.38							0.87	
				IC4	2.34							0.86	
				IC5	2.49							0.85	
Absorptive Capacity	0.96	0.97	0.66	KAAc1	2.57								0.81
				KAAc2	2.77								0.83
				KAAc3	2.61								0.81
				KAAs1	2.67								0.82
				KAAs2	2.94								0.84
				KAAs3	2.57								0.81
				KAAs4	2.47								0.80
				KAEx1	2.57								0.81
				KAEx2	2.51								0.81
				KAEx3	2.49								0.80
				KATr1	2.70								0.82
				KATr2	2.49								0.80
				KATr3	2.72								0.82
				KATr4	2.69								0.82
SRMR: 0.02, d_ULS: 1.45, d_G:0.78, Chi-square: 2,019.83, NFI: 0.91 *: Variables are excluded due to outer loading <0.7													

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Discriminant validity was assessed using both the Fornell-Larcker criterion and the Heterotrait-Monotrait (HTMT) ratio. According to the Fornell-Larcker criterion, each construct's square root of AVE exceeds its correlations with other constructs. For example, the square root of AVE for ACAP is 0.82, which is higher than its correlations with other constructs, supporting discriminant validity (see Table 2). Additionally, HTMT values were all below the 0.9 threshold, further confirming discriminant validity. For instance, the HTMT between "Combinative Capabilities" and "Corporate Culture" is 0.80, indicating distinct constructs (see **Table 2**).

In summary, the results indicate that the measurement model exhibits strong reliability and validity, thus supporting the constructs used in this study for further analysis.

Table 2. The measurements' discriminant validity

Fornell-Larcker criterion	**ACAP**	**AK**	**CC**	**CCL**	**ELC**	**IC**	**KMP**	**KN**
Absorptive Capacity (ACAP)	0.82							
Accumulated Knowledge (AK)	0.70	0.87						
Combinative Capabilities (CC)	-0.66	-0.69	0.87					
Corporate Culture (CCL)	0.68	0.61	-0.73	0.86				
Employee Learning Capability (ELC)	0.71	0.66	-0.58	0.58	0.87			
Industry Competition (IC)	0.07	-0.17	0.13	-0.08	-0.07	0.85		
Knowledge Management Process (KMP)	0.78	0.74	-0.81	0.71	0.61	-0.04	0.85	
Knowledge Networks (KN)	0.70	0.58	-0.58	0.62	0.72	-0.07	0.61	0.86
HTMT Criterion	**ACAP**	**AK**	**CC**	**CCL**	**ELC**	**IC**	**KMP**	**KN**
Absorptive Capacity (ACAP)	0.74							
Accumulated Knowledge (AK)	0.70	0.75						
Combinative Capabilities (CC)	0.72	0.67	0.80					
Corporate Culture (CCL)	0.75	0.71	0.63	0.63				
Employee Learning Capability (ELC)	0.08	0.19	0.15	0.10	0.08			
Industry Competition (IC)	0.82	0.80	0.87	0.77	0.65	0.06		
Knowledge Management Process (KMP)	0.74	0.62	0.62	0.67	0.77	0.08	0.65	

4.2. Structural model evaluation

The author assessed the structural model to evaluate the hypothesized relationships by analyzing path coefficients, t-values, and p-values, thereby determining the significance and strength of each relationship (see **Table 3**). The bootstrapping technique, which utilizes 5,000 resamples, was employed to evaluate the stability and significance of the model estimates, yielding robust confidence intervals for the path coefficients (Sarstedt et al., 2021).

The findings substantiate the majority of the proposed hypotheses, demonstrating significant positive impacts of internal factors on ACAP. Hypothesis **H1**, which suggested that AK has a positive effect on ACAP, is supported (O=0.19, p-value <0.001). **H3**, **H4**, and **H6** indicate that ELC, KMP, and KN have a positive effect on ACAP, with a p-value of less than 0.001, signifying a strong impact. Hypothesis 2, which posited the positive impact of Combinative Capabilities on Absorptive Capacity, is supported (O=0.13, p-value=0.05), indicating that Combinative Capabilities enhance Absorptive Capacity. Additionally, **H5** concerning CCL is substantiated by p-values of 0.02, highlighting their critical function in improving ACAP (Refer to **Table 4**).

The moderation hypotheses yield noteworthy results. Three hypotheses, **H7.2**, **H7.3**, and **H7.4**, are supported, suggesting that IC moderates the relationships among CC, ELC, KMP, and ACAP. Conversely, the other hypotheses (**H7.1**, **H7.5**, and **H7.6**) lack empirical support. The findings demonstrate that IC plays a significant moderating role in specific relationships, particularly those related to Combinative Capabilities, Employee Learning Capability, and Knowledge Management Processes. This underscores the importance of firms leveraging these internal factors in competitive contexts.

Table 3. Hypothesis results

Path	**Path coefficient (O)**	**Standard deviation (SD)**	**t-value**	**p-value**	**Results**
AK -> ACAP	0.19	0.05	3.96	0.00	**H1:** Supported
CC -> ACAP	0.13	0.07	1.96	0.05	**H2:** Supported
ELC -> ACAP	0.20	0.05	4.05	0.00	**H3:** Supported
KMP -> ACAP	0.48	0.06	7.62	0.00	**H4:** Supported
CCL -> ACAP	0.10	0.05	2.27	0.02	**H5:** Supported
KN -> ACAP	0.17	0.04	3.74	0.00	**H6:** Supported
IC x AK -> ACAP	0.06	0.05	1.24	0.21	**H7.1:** Not supported
IC x CC -> ACAP	0.17	0.06	2.77	0.01	**H7.2:** Supported
IC x ELC -> ACAP	-0.11	0.05	2.03	0.04	**H7.3:** Supported
IC x KMP -> ACAP	0.19	0.06	3.02	0.00	**H7.4:** Supported
IC x CCL -> ACAP	0.01	0.04	0.30	0.76	**H7.5:** Not supported
IC x KN -> ACAP	0.04	0.04	0.91	0.36	**H7.6:** Not supported

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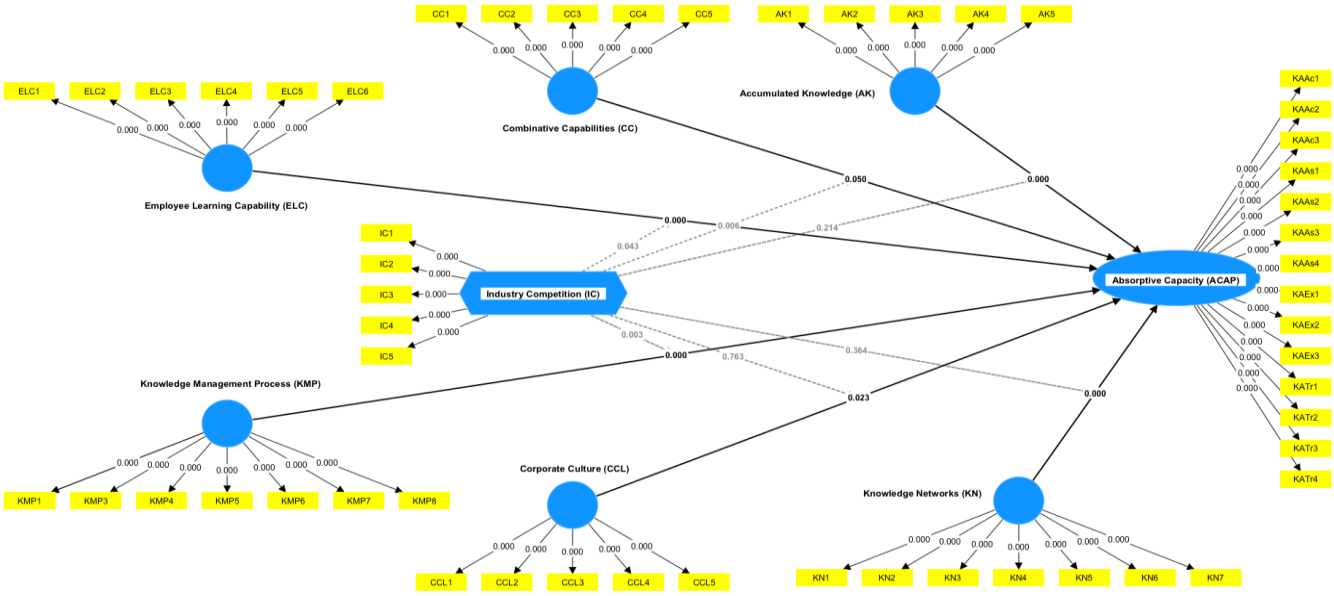

Figure 2. Hypothesis results

4.3. Multigroup Analysis (MGA)

The Multigroup Analysis (MGA) examines the moderating effects of enterprise size on the relationships between various internal factors and ACAP, using data from medium enterprises (ME), large enterprises (LE), and mega enterprises (MeE).

4.3.1. Medium enterprises (ME) and ACAP

The analysis of medium enterprises (ME) reveals distinct patterns in how internal factors influence ACAP. Among the internal factors, KMP exhibits the strongest positive impact on ACAP ($\beta = 0.545$, $p < 0.001$), suggesting that medium-sized firms prioritize structured knowledge management systems to enhance their ability to absorb and utilize external knowledge. This aligns with prior studies emphasizing the role of formalized processes in resource-constrained environments (Gold et al., 2001). ELC also shows a significant effect ($\beta = 0.262$, $p < 0.001$), highlighting the importance of continuous skill development in smaller firms. However, CC ($\beta = 0.096$, $p = 0.36$) and CCL ($\beta = 0.05$, $p = 0.53$) are not statistically significant, possibly because medium enterprises may lack the infrastructure or cultural maturity to integrate diverse knowledge sources effectively. Notably, IC moderates the relationship between CC and ACAP ($\beta = 0.232$, $p = 0.08$), though this effect is marginal, indicating that competitive pressures only partially drive combinative efforts in ME.

4.3.2. Large enterprises (LE) and ACAP

For large enterprises (LE), KN emerges as the most influential factor ($\beta = 0.324$, $p < 0.001$), reflecting their ability to leverage extensive external collaborations and information flows to

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enhance ACAP, consistent with Tsai's (2001) findings on network centrality. KMP remains significant (β = 0.327, p < 0.001), but its impact is weaker compared to ME, suggesting diminishing returns as firms scale. Surprisingly, ELC (β = 0.172, p = 0.07) and CC (β = 0.014, p = 0.89) show limited effects, potentially due to bureaucratic inertia or fragmented learning initiatives in larger organizations. The moderating role of IC is negligible across most relationships (e.g., IC × KMP: β = 0.055, p = 0.63), implying that large firms may rely more on internal resources than external competitive stimuli to drive ACAP.

4.3.3. Mega enterprises (MeE) and ACAP

In mega enterprises (MeE), AK has the strongest direct effect on ACAP (β = 0.274, p = 0.02), underscoring the value of institutionalized knowledge repositories in highly complex organizations (Zahra & George, 2002). Conversely, ELC (β = 0.015, p = 0.90) and **CC** (β = 0.001, p = 1.00) are insignificant, possibly due to rigid hierarchies stifling dynamic learning and cross-functional collaboration. The moderating effect of IC is pronounced for KMP (β = 0.47, p = 0.01), indicating that intense competition drives mega-firms to optimize knowledge processes aggressively. However, KN (β = 0.18, p = 0.08) and CCL (β = 0.221, p = 0.02) show mixed results, suggesting that while networks and culture matter, their contributions are context-dependent in large-scale operations.

Table 4. MGA results

MGA	**β** (ME)	**β** (LE)	**β** (MeE)	**t-value** (ME)	**t-value** (LE)	**t-value** (MeE)	**p-value** (ME)	**p-value** (LE)	**p-value** (MeE)
AK -> ACAP	0.126	0.156	0.274	1.714	1.634	2.363	0.09	0.10	0.02
CC -> ACAP	0.096	0.014	0.001	0.91	0.134	0.006	0.36	0.89	1.00
CCL -> ACAP	0.05	0.033	0.221	0.632	0.411	2.31	0.53	0.68	0.02
ELC -> ACAP	0.262	0.172	0.015	3.351	1.809	0.127	0.00	0.07	0.90
KMP -> ACAP	0.545	0.327	0.302	5.004	3.06	1.893	0.00	0.00	0.06
KN -> ACAP	0.18	0.324	0.18	2.309	3.936	1.726	0.02	0.00	0.08
IC x KN -> ACAP	0.003	0.09	0.134	0.038	0.912	1.257	0.97	0.36	0.21
IC x CCL -> ACAP	0.008	0.029	-0.037	0.1	0.308	0.379	0.92	0.76	0.71
IC x ELC -> ACAP	-0.06	0.007	-0.144	0.715	0.06	1.172	0.48	0.95	0.24
IC x CC -> ACAP	0.232	0.029	0.327	1.769	0.271	2.087	0.08	0.79	0.04
IC x AK -> ACAP	0.1	-0.119	-0.106	1.288	1.072	1.092	0.20	0.28	0.28
IC x KMP -> ACAP	0.152	0.055	0.47	1.282	0.476	2.777	0.20	0.63	0.01

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Note: ME: Medium Enterprises, LE: Large Enterprises, MeE: Mega Enterprises

5. Discussion

5.1. The moderating role of IC

The results of this study highlight the significant moderating role of industry competition (IC) in the relationship between certain internal factors and absorptive capacity (ACAP). Specifically, IC was found to moderate the relationships between combinative capabilities (CC), employee learning capability (ELC), knowledge management process (KMP), and ACAP. This suggests that in highly competitive environments, firms are more likely to leverage these internal factors to enhance their absorptive capacity.

The findings align with previous research by Tsai (2001) and Porter & Strategy (1980), which emphasized that competitive pressures drive firms to innovate and improve their knowledge management capabilities. However, the moderating effect of IC was not significant for accumulated knowledge (AK), corporate culture (CCL), and knowledge networks (KN). This could imply that these factors are more intrinsic to the firm and less influenced by external competitive pressures.

5.2. Comparison with previous studies

The positive impact of accumulated knowledge (AK) on ACAP is consistent with the findings of J. J. Jansen et al. (2005) and Zahra & George (2002), who argued that a firm's existing knowledge base is crucial for absorbing new knowledge. Similarly, the significant influence of combinative capabilities (CC) on ACAP supports the work of Bosch Bosch et al. (1999) and J. J. Jansen et al. (2005), who highlighted the importance of integrating knowledge from diverse sources.

The strong positive relationship between employee learning capability (ELC) and ACAP is in line with the findings of Liao et al. (2008) and Kim (2009), who emphasized the role of continuous learning in enhancing absorptive capacity. The significant impact of knowledge management processes (KMP) on ACAP also corroborates the findings of Gold Gold et al. (2001) and Liao Liao et al. (2008), who argued that effective knowledge management is essential for innovation and performance.

However, the lack of a significant moderating effect of IC on the relationship between AK, CCL, KN, and ACAP contrasts with some previous studies, such as those by Vega-Jurado et al. (2008) and Chang Chang et al. (2012), who found that competitive pressures generally enhance the impact of internal factors on ACAP. This discrepancy could be due to the unique context of the Vietnamese e-commerce sector, where firms may prioritize certain internal factors over others in response to competition.

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6. Conclusion

6.1. Theoretical contributions

This study contributes to the literature on absorptive capacity by examining the internal factors that influence ACAP in the context of the Vietnamese e-commerce sector. The findings highlight the importance of accumulated knowledge, combinative capabilities, employee learning capability, and knowledge management processes in enhancing ACAP. Additionally, the study provides new insights into the moderating role of industry competition, suggesting that competitive pressures can amplify the impact of certain internal factors on ACAP.

6.2. Practical implications

For practitioners, the results suggest that e-commerce firms should focus on developing their internal capabilities, particularly in areas such as knowledge management and employee learning, to enhance their absorption capacity. In highly competitive environments, firms should also prioritize the integration of knowledge from diverse sources and the development of combinative capabilities to stay ahead of the competition.

6.3. Limitations and Directions for Future Research

This study has several limitations. First, the data were collected from a single country (Vietnam), which may limit the generalizability of the findings. Future research could expand the scope to include other countries or regions. Second, the study focused on the e-commerce sector, and the results may not be applicable to other industries. Future research could explore the impact of internal factors and industry competition on ACAP in different sectors.

Additionally, the study used cross-sectional data, which limits the ability to draw causal inferences. Future research could employ longitudinal data to understand better the dynamic relationships between internal factors, industry competition, and ACAP. Finally, the study did not explore the potential role of external factors, such as government policies or technological advancements, in influencing ACAP. Future research could investigate how these external factors interact with internal capabilities to shape absorptive capacity.

Declaration of Competing Interest

The authors declare no conflict of interest.

Data availability

The authors do not have permission to share data.

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