

# An Empirical Study of Competitive Intelligence Activities, Knowledge Management Processes and Innovation Performance

WEI ZUOCHUN

## Abstract

For small and medium-sized technological enterprises, due to the lack of resources and limited innovation capabilities, it is difficult for enterprises to achieve sustainable innovation and development on their own. Innovation in technological SMEs requires efficient use and allocation of competitive intelligence acquisition activities, and the lessons learned, and business methods acquired through the knowledge management process, combined with the innovative capabilities of knowledge employees, are internalized in the organization to continuously enhance organizational creativity, which is the personality of technological SMEs. Based on the individual characteristics of small and medium-sized technological enterprises, this study's purpose is focuses on exploring the relationship between competitive intelligence acquisition, knowledge management process, and innovation performance. By strengthening the positive influencing factors of innovation performance of small and medium-sized technological enterprises, the internal resource integration and development of enterprises can be achieved, thus achieving innovation output and maintaining competitive advantage. The quantitative design of this study takes small and medium-sized technological enterprises as the research object, takes "competitive intelligence activities-technological innovation performance of small and medium-sized technological enterprises" as the entry point, takes the knowledge management process as the mediator variable, divides the knowledge management process into three dimensions: The findings show with the research and practical implications that the knowledge creation, knowledge sharing, and knowledge utilization, and introduces the innovative ability of knowledge employees as the moderating variable for exploring the detailed and rich impact path of competitive intelligence activities on enterprise innovation performance.



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About Author (s)

WEI ZUOCHUN, Asia Metropolitan University, Malaysia.

## Introduction

As early as 2003, the Strategic and Competitive Intelligence Professionals (SCIP), as an authoritative organization in the field of competitive intelligence, defined competitive intelligence as the systematic and ethical collection, analysis, and management of external information that may affect planning, decision-making, and business operations. Generally speaking, competitive intelligence includes information about competitors, customers, suppliers, and related technologies. (Fang 2020; Zhu et al. 2020). In the era of knowledge economy, with the increasing degree of informationization, competitive intelligence can be ranked as the fourth reason affecting the survival of enterprises after capital, technology, and talent. According to the competitive environment in which companies live, this paper defines competitive intelligence activities as the process of intelligence processing of explicit or implicit information resources about customers, competitors and suppliers obtained based on external market information in order to gain and maintain the innovative advantage of companies. From the resource-based theory and the characteristics of competitive intelligence, the competitive intelligence activities that affect the innovation performance of enterprises are divided into three dimensions, namely, customer-oriented competitive intelligence activities, competitor-oriented competitive intelligence activities, and supplier-oriented competitive intelligence activities. (Chen et al. 2017; Deng & Ye 2020; Fang 2020; Zhu et al. 2020). This paper takes small and medium-sized technological enterprises as the research object, based on the perspective of competitive intelligence activities-knowledge management process, analyzes the mechanism of the impact of enterprise competitive intelligence activities on enterprise innovation performance, and opens new ideas for improving enterprise innovation performance. Based on the distribution and data collection of questionnaires (530 questionnaires were distributed) and the measurement of variables according to their definition and dimensions, as well as the empirical analysis, descriptive statistics, reliability and validity tests, correlation analysis and hierarchical regression of the scales were used to conduct empirical tests. (Deng & Ye 2020; Fang 2020; Zhu et al. 2020). Through the research results, this paper shows that the integration of competitive intelligence activities and knowledge management processes can connect enterprises with the external competitive environment, and can transfer the competitive intelligence information obtained from the external competitive environment into the internal of the enterprise, realizing the integration of external competitive intelligence information and enterprise management, which is helpful for enterprises to carry out exploratory innovation. The process of knowledge management innovation plays a mediating role in competitive intelligence and corporate performance, and competitive intelligence activities have a positive impact on corporate performance. Finally, this paper has put forward management implications and suggestions for small and medium-sized technological enterprises. (Chen et al. 2017; Deng & Ye 2020; Fang 2020; Zhu et al. 2020).

## Background of Study

In recent years, against the backdrop of rapid global technological and Internet economic development, China's industrial restructuring has achieved significant results, and at the same time, the marketization process in China has also made rapid development. Currently, there is no better example of a successful combination of economy and technology than technological SMEs. (Deng & Ye 2020; Fang 2020; Zhu et al. 2020). Small and medium-sized technological enterprises have become the backbone of China's indigenous innovation competency, playing an important role in promoting economic growth and promoting social harmony and stability. Therefore, studying the innovation problems of small and medium-sized technological enterprises has both theoretical and practical significance. Large technological enterprises have strong development strength, sufficient resource development, and a continuous source of innovation; For small and medium-sized technological enterprises, the sustainable

development of the enterprise itself is difficult to achieve without a deep relationship established through external social networks. The severe shortage of resources and limited innovative ability have become the short board that restricts development. Therefore, if enterprises want to obtain valuable learning resources for innovation activities, they must establish linkage with external social networks. (Chen et al. 2017; Deng & Ye 2020; Fang 2020; Zhu et al. 2020; Zhan & Wang 2020; Zhang et al. 2020; Yu et al. 2020).

This linkage relationship that concerns actively obtaining competitive intelligence and the demand for organizational personnel's innovative ability is more intense than that of large technological enterprises and can accelerate the process of enterprise innovation. Innovations of small and medium-sized technological enterprises nowadays require efficient utilization and allocation of competitive intelligence activities, and through the process of knowledge management and communication and learning with partners, the experience and lessons, and business methods, combined with the innovative ability of knowledge employees, are internalized in the organization to continuously enhance organizational creativity, which is the personality of small and medium-sized technological enterprises. It seems that small and medium-sized technological enterprises can efficiently achieve the integration and development of internal resources through the process of knowledge management and can fully utilize competitive intelligence activities to obtain new resources, which may have an impact on the innovation performance of small and medium-sized technological enterprises. (Chen et al. 2017; Deng & Ye 2020; Fang 2020; Zhu et al. 2020).

### **Problem Statement**

Due to the turbulence of globalization and intensified market competition, the product development and market lifecycle of enterprises are becoming increasingly shorter. Open innovation has been steadily adopted by most domestic modern enterprises to accelerate the innovation process and expand existing markets. This means that current business organizations are transitioning from a complete internal and closed way of operating to a more open and collaborative way. (Chen et al. 2017; Deng & Ye 2020; Fang 2020; Zhu et al. 2020; Zhan & Wang 2020; Zhang et al. 2020; Yu et al. 2020). Innovation relies heavily on the flow of information within and outside its boundaries, as well as a large amount of external knowledge, involving customers, suppliers, research institutions, and even competitors. Research shows that the more information a company obtains about innovation, the more choices it has for innovation. Therefore, companies must conduct appropriate searches, understand, and utilize the latest competitive intelligence. However, there is currently little research on the impact mechanism of the integration of competitive intelligence activities and knowledge management processes on corporate innovation performance, and the process of the dynamic impact of competitive intelligence activities on corporate innovation performance is also unclear. 1. Do competitive intelligence activities have a positive impact on corporate innovation benefits? Does competitive intelligence have a positive impact on the knowledge management process? 3. Does the knowledge management process have a positive impact on corporate innovation performance? 4. Does the knowledge management process play a mediating role in the positive effect of competitive intelligence activities on corporate performance? Does the innovation activity of knowledge employees have a positive moderating effect on the relationship between the knowledge management process and corporate innovation performance? Regarding the above issues, this study will provide new ideas for improving corporate performance by analyzing the impact mechanism of competitive intelligence activities and knowledge management innovation process on corporate performance. (Fang 2020; Zhu et al. 2020).

## Research Questions

Based on the research foundation of predecessors and the actual needs of small and medium-sized technological enterprises, this study intends to propose the following research questions:

1. Do competitive intelligence activities have a positive impact on corporate innovation benefits?
2. Do competitive intelligence activities have a positive impact on the knowledge management process?

## Research Objectives

The specific content of the research objective is as follows:

- (1) The impact mechanism between competitive intelligence activities of enterprises and innovation performance of small and medium-sized technological enterprises (Competitive intelligence activities–innovation performance of technology-based SMEs) The innovation performance of technology-based SMEs is positively influenced by competitive intelligence activities.
- (2) The impact mechanism between competitive intelligence activities and knowledge management processes

## Literature review

### Dependent Variable—Innovation Performance of Small and medium-sized technological enterprise

As the research object of this study is small and medium-sized technological enterprises, the specific innovation performance of this study refers to the innovation performance of technology-based SMEs. In this regard, this study first sorts out the connotation of small and medium-sized technological enterprises in the literature, and then sorts out their innovation performance in the literature. Unless otherwise specified, the innovation performance of this research refers to the innovation performance of small and medium-sized technological enterprises. (Fang 2020; Zhu et al. 2020). Small and medium-sized technological enterprises are usually created and managed by entrepreneurial individuals, especially micro and small enterprises (Marion et al., 2013; Gong et al., 2013; Verbano and Venturini, 2013). In the organizational environment, the ability to take risks and provide organizational support ranks high among the factors of leadership, culture, and health, which are considered essential prerequisites for a successful innovation venture (Garcia-Granero et al., 2015). Therefore, in contrast to large companies, the management of small and medium-sized technology companies seems to be more motivated and focused on achieving potentially high returns. In other words, it is the potentially high returns from the effort, money and time invested that justify the reason for the existence of resource-constrained technology-based SMEs (Dosi, 1988). For the management of micro-enterprises, this phenomenon is even more pronounced. Such enterprises typically have fewer than 25 employees (Pett and Wolff, 2012), and sometimes the entire staff of a startup consists of just a few founders (Nartisa, 2012; Marion, 2013). Small and medium-sized enterprises can be divided into two subcategories based on their size: small and medium-sized (Lopez-Ortega et al., 2016). Small and medium-sized enterprises are considered to be companies with 25 to 100 and 100 to 500 employees, respectively (Pett and Wolff, 2012). There is significant heterogeneity between these two types of small and medium-sized enterprises in terms of entrepreneurship and learning direction (Pett and Wolff, 2012). The tendency or ability for innovation and learning may depend on the size of the company, which has been widely studied as a typical prerequisite for innovation (Cohen and Levinthal, 1990; Yuan Wang et al., 2015). The classification of technology-based SMEs in this study aims to identify SME firm profiles according to selected open innovation network dimensions in the Italian manufacturing industry (Verbano et al., 2015), and in this

study, small and medium-sized firms are classified as those with 50 to 100 and 100 to 500 employees, respectively.

### **Independent Variable: Competitive Intelligence Activities**

The term "intelligence" originated in military science and strategy. In a narrow sense, "intelligence" originally referred to "reports on enemy situations during war" (as defined in the 1939 edition of "Cihai"). In a broader sense, "intelligence" refers to the analysis, processing, and output of information materials, and has characteristics such as antagonism, strategic importance, and added value. The Art of War by Sun Tzu says: "Knowing the enemy and yourself, you can fight a hundred battles and win them all." Once intelligence is connected with users and provides important support in decision-making and action, it can help users clarify the situation in military operations and gain an advantage in business competition. "Competition" is a power-seeking activity and behavioral performance carried out by two or multiple parties with conflicting interests to seize the favorable development situation for themselves. Under the market economy environment, enterprises adopt various competitive behaviors that are beneficial to themselves to achieve the maximization of interests, which promotes the theory and practice of competitive intelligence (Qin et al., 2001). There are currently multiple interpretations of the definition of competitive intelligence, which can be summarized as process theory, product theory, and comprehensive theory. The Strategic and Competitive Intelligence Professionals (SCIP) in the United States believes that competitive intelligence is a process in which accurate, relevant, specific, timely, forward-looking, and actionable intelligence about the business environment, competitors, and the organization itself is collected, analyzed, and disseminated in a manner consistent with professional ethics. Stanwyn, Didiyo, Ian. Gordon and Miao all agree with this view, among which Gordon believes that competitive intelligence is a process from obtaining and analyzing publicly available information to competitive intelligence, competitive strategy, and then generating competitive reports and competitive advantages (Qin et al., 2001).

Professor John E. Prescott of the University of Pittsburgh considered competitive intelligence as a refined information product related to some aspects of the external and/or internal environment (Jing et al., 2009), which is a high-value, time-sensitive intelligence obtained after collation, analysis and processing, and is also superimposed with new value; Greene considered competitive intelligence to be a product of information about a firm in its competitive environment. John Prescott Prescott has earlier proposed that competitive intelligence has the characteristics of both product and process, and believes that competitive intelligence is a refined information product, as well as the process of evaluating and analyzing the current situation of the industry in which it is located, the capabilities and behaviors of competitors, etc., in order to maintain the competitive advantage of enterprises; Bao, a researcher, believed that competitive intelligence is both a process and a product, with the process referring to the collection and analysis of competitive intelligence and the product referring to the resulting intelligence or strategy (Bao, 1998); Qin believed that three main characteristics of competitive intelligence constitute the central content of the connotation of competitive intelligence: firstly, competitive intelligence is a value-added intelligence product; secondly, competitive intelligence reflects a dynamic and complex process; thirdly, competitive intelligence embodies organizational characteristics (Qin Ke et al., 200.); Chen argued that there are many definitions of competitive intelligence, but in fact the precise meaning of competitive intelligence can be described as a definition spectrum consisting of several definitions under different constraints, and the spectrum contains constraints, core parts and contents of the spectrum. To summarize, competitive intelligence is an organized and systematic information behavior within the scope of law and business ethics, which serves the

strategic management of enterprises. It is a process that starts from collecting information that affects the competitive advantage of enterprises, and forms competitive intelligence through intellectual value-added, and provides a reference for decision makers to act accordingly to gain competitive advantage. (Chen, F. 2014.); The Society of Competitive Intelligence China (SCIC) defines competitive intelligence as both a product and a process, which "refers to an organization's comprehensive monitoring process of the overall competitive environment and competitors in order to achieve competitive advantage. It is the process of monitoring the overall competitive environment and competitors by using legal and ethical means to systematically track, collect, analyze, and process information and research that may have an impact on the development, decision-making, and operation of an enterprise over a long period of time" (Society of Competitive Intelligence China (SCIC), About Competitive Intelligence, 2015).

### **Connotation of the Knowledge Management Process**

The following are the seven knowledge management processes identified by Becerra-Fernandez and Sabherwal (2010): acquisition, creation, refinement, storage, transfer, sharing, and utilization. According to the classic model provided by Ikujiro Nonaka and Toyama (2008), the creation of knowledge is a single dimension of tacit knowledge, and through social interaction, knowledge becomes explicit knowledge of other individuals, groups and even organizations. It can be said that organizational learning is recognized through four processes, specifically explanation, intuition, integration, and institutionalization. These four processes occur within individuals, groups, and organizations, thus creating a seamless and continuous interaction between tacit knowledge and explicit knowledge. As knowledge creation is a process and knowledge itself is a strategic organizational asset, knowledge management has become a cornerstone of enterprise strategy for creating value, and this view is confirmed by Al-Sudairy and Vasista (2012). Davenport et al. (2007) explained that knowledge management consists of three processes: creating, disseminating, and using knowledge to achieve organizational goals. Similarly, Stewart et al. pointed out that knowledge management has four processes: generation, organization, development, and distribution (Stewart, Mansingh, 2010). Stewart's addition to the three key process-based studies developed by Davenport is part of the organization. This is so because the organization must systematically perform all internal knowledge retrieval and distribution, including specific applications to the knowledge base. Therefore, the management of knowledge resources is crucial for organizational competition. (Chen et al. 2017; Deng & Ye 2020; Fang 2020; Zhu et al. 2020; Zhan & Wang 2020; Zhang et al. 2020; Yu et al. 2020).

### **Methodology**

#### **Research Design**

The literature research method mainly refers to the study of literature results in the relevant research field, through the collection and analysis of information related to the research content, to understand the latest research results in the field, thus comprehensively grasping the problem to be studied. This study applied the ideas of empirical research in terms of empirical testing of conceptual models and research hypotheses and used conceptual models and variable-related hypotheses as the basis for design ideas. A large amount of literature research has been conducted on the preliminary data preparation and data sources required for empirical research, and many previous research results have been used. Based on this, reliable theoretical and data support was provided for the measurement of variables, as well as the verification of data reliability, accuracy, and effectiveness in this study. Through the arrangement of the questionnaire, repeated consideration of the questions, and the use of efficient survey methods, this study conducted preliminary data collection. By reading a large

amount of relevant literature, the variable measurement method of this study was reasonably determined. The variables mainly include competitive intelligence activities, knowledge management processes, innovative abilities of knowledge employees, and corporate innovation performance. According to the variable presented in Table 3-1, they were refined into a total of 8 detailed indicators. By pre-testing, ensure the reliability, validity, and accuracy of the feedback obtained after the questionnaire is distributed. Equation and linear regression to verify the model fitting and related hypotheses.

### **Determining and Selecting Research Respondents**

This study mainly explores the mechanism of the relationship between competitive intelligence activities, knowledge management processes, and enterprise innovation performance of small and medium-sized technological enterprises in China. Therefore, there are two main points to explain regarding the determination and selection of research objects: (1) The vast territory of China has led to significant cultural differences among different regions, especially in Hong Kong, Macao, and Taiwan. Their institutional environment, property rights model, and system mechanisms are completely different from those in mainland China, which also affects the competitive intelligence activities and knowledge management processes of all related enterprises. Therefore, this research will not include enterprises from Hong Kong, Macao, and Taiwan. (2) The target population of this study is technology-based SMEs that have been established for more than three years and have innovative behaviors or certain big data capabilities. The questionnaire survey mainly utilizes social resources such as industry associations, group organizations, and industry exhibitions, and interviews and questionnaires are conducted with grassroots personnel or managers of the enterprises that meet the requirements, so as to achieve complete coverage as far as possible and effectively avoid possible research bias caused by other discrepancy factors.

### **Questionnaire Design**

Currently, one of the most widely used research methods in the field of management is the empirical research method, because the effectiveness of empirical research has been demonstrated. Questionnaire survey is an essential and important part of empirical research, through which a lot of effective information can be obtained. Therefore, in order to obtain more effective conclusions, the questionnaire must be designed with the highest possible rationality, normative Ness and completeness, which directly affects the results of the survey.

### **Data collection**

This study distributed questionnaires and collected data from January 2022 to March 2022. The main purpose of this survey is for scientific research. After the respondents understand the true purpose of the entire process, the information they provide can reflect their true intentions and subjective opinions. The information related to the respondents will be kept strictly confidential, and filling out the survey questionnaire will not have any negative impact on the respondents. In this way, it can ensure the authenticity and reliability of the recovered survey questionnaire to the greatest extent and have certain scientific research value. Throughout the data collection and sampling process, we synchronously conducted actual research on some enterprises to understand the real situation of competitive intelligence activities, knowledge management processes, knowledge workers' innovative abilities, and enterprises' innovation performance. There are two ways to distribute the survey questionnaire: on-site distribution and electronic distribution. In order to ensure the comprehensiveness and availability of data, we contacted the relevant government departments to obtain a list of representative enterprises in the region, and the relevant departments helped to distribute paper questionnaires. Field visits were made to

representative companies and questionnaires were distributed, at the same time, questionnaires were also distributed by acquaintances and partners. Electronic distribution refers to distributing survey questionnaires via email. Since e-mail distribution is mainly targeted at companies that are inconvenient to visit or are located far away, the electronic questionnaire and instructions for filling it out are sent to the company by e-mail. After the company completes the questionnaire, it is returned in a timely manner by e-mail or by returning the completed electronic questionnaire. The research was conducted with technology-based SMEs as the research object, and the respondents obtained through social resources were located in Shenzhen, Fuzhou, Zhuhai, Xiamen, Dongguan and Guangzhou, and the industries covered electronic information, biomedical, software development and high-tech services, ensuring that the sample was diverse, representative and explanatory.

**Measurement of Variables**

**Measurement of Competitive Intelligence Activities**

This study's variable measurement refers to the achievements of Hsu, L-C (2007), which have a certain level of maturity and reference value. At the same time, it combines the management characteristics and industry features of Chinese enterprises to reduce the impact of cultural differences and other factors on the design of the measurement scale. As shown in Table 3-1.

**Table 3-1 Measurement of Competitive Intelligence Activity Variable**

Source of the literature	Variable Name	Items
HSU, L-C (2007); ZHAO & XIAO (2016); KANG ET AL., 2017; ZHAN & WANG (2020)	Competitive Intelligence Activities	(1) Your Company Often Exchanges Methods And Experiences With Partners In The Same Industry.
		(2) Your Company Has Dedicated Personnel Responsible For Maintaining Contact With Partners Within The Industry.
		(3) Your Company Will Share The Experience And Lessons Learned In Product Research And Development With Partners In The Industry.
		(4) Your Company Gains The Necessary Experience And Methods From Partners Within The Industry.
		(5) Your Company And Industry Partners Jointly Invest In Purchasing The Latest Communication And Office Equipment For The Convenience Of Sharing Experiences And Methods.
		(6) Your Company Often Shares Methods And Experiences With Competing Companies.
		(7) Your Company Has Dedicated Personnel Responsible For Maintaining Relationships With Competing Companies.
		(8) Your Company Will Gain Product Research And Development Lessons From Companies With Which It Competes.
		(9) Your Company Often Exchanges Methods And Experiences With Partners From Other Industries.
		(10) Your Company Can Fully Absorb The Experience And Methods Received From Partners In Other Industries.

**Measurement of the Knowledge Management Process**

The survey tool consists of several questions related to the knowledge management process. The concept definition of knowledge management construction comes from Zaim (2007) and is similar to a survey of organizational renewal capability checklist, as well as measurements used by Kianto et al. (2016). They developed a multi-project model to implement knowledge management processes in the service industry, which was used in a study investigating the impact of knowledge management processes on leadership (Zaim & Tarim, 2014). The original questionnaire consists of 38 items, involving four processes of knowledge management. In the initial measures used for this study, knowledge creation includes 8 items, knowledge sharing includes 8 items, knowledge utilization includes 8 items, and knowledge management performance includes 5 items. Each item's rating uses a 7-point Likert scale, ranging from



strongly disagree (1) to strongly agree (7). The final version of the questionnaire items, which underwent project cleaning and factor analysis, is presented in the Appendix. The variable measurement items for the knowledge management process in this study are shown in Table 3-2.

**Table 3-2 Measurement of Knowledge Management Process Variable**

SOURCE OF THE LITERATURE	VARIABLE NAME		ITEMS
ZAIM & TARIM (2014); ZHANG ET AL. (2018); ZHANG ET AL. (2020)	Knowledge management process	Knowledge creation	(1) Your company encourages all employees to keep learning.
			(2) Your company encourages all employees to make suggestions.
			(3) Your company's employees actively participate in the process of knowledge generation.
		Knowledge sharing	(1) Your company attaches great importance to sharing knowledge with colleagues.
			(2) Your company's email and mobile applications are effectively used to share knowledge among colleagues.
			(3) There is effective communication among colleagues in your company.
		Knowledge utilization	(1) Your company has an accurate and effective decision-making process.
			(2) Your company can utilize the organization's knowledge base.
			(3) Your company encourages the implementation of employee ideas in work-related activities.

**Pre-test Reliability and Validity Analysis**

Reliability analysis, also known as reliability statistics, refers to the degree of consistency in the results obtained when the same thing is repeatedly measured. Frequently used reliability indicators include stability, reliability, and internal consistency, of which the most commonly used is internal consistency, that is, the degree of intrinsic consistency or homogeneity among observed items (Li, 2004). There are two main criteria for judging the internal consistency index: CITC index and  $\alpha$  coefficient. Churchill proposes the Corrected Item-Total Correlation (CITC) indicator, which removes indicators below 0.5 (Churchill, 1979). Cronbach proposed  $\alpha$  coefficient of internal consistency index. If the  $\alpha$  coefficient is more than 0.7, it means that the reliability of the index is relatively good (Wu, 2003). By using SPSS 22.0, an analysis was conducted on the various variables of the study and on each questionnaire, as shown in Table 3-6. From the table, it can be seen that the CITC of each item is greater than 0.5, and Cronbach's alpha if item deleted is higher than the original Cronbach's alpha coefficient. Therefore, each item should be retained, and each scale item has good internal consistency.

**Table 3-3 Item-Total Statistics**

VARIABLES	ITEM	CITC	CRONBACH'S ALPHA IF ITEMS DELETED	CRONBACH'S ALPHA COEFFICIENT
COMPETITIVE INTELLIGENCE ACTIVITIES	B1	0.790	0.915	0.842
	B2	0.708	0.920	
	B3	0.692	0.921	
	B4	0.618	0.925	
	B5	0.863	0.912	
	B6	0.766	0.917	
	B7	0.756	0.917	
	B8	0.681	0.921	
	B9	0.622	0.924	
	B10	0.695	0.921	
KNOWLEDGE SHARING	D1	0.678	0.758	0.823
	D2	0.675	0.760	
	D3	0.684	0.752	
KNOWLEDGE	E1	0.675	0.820	0.846

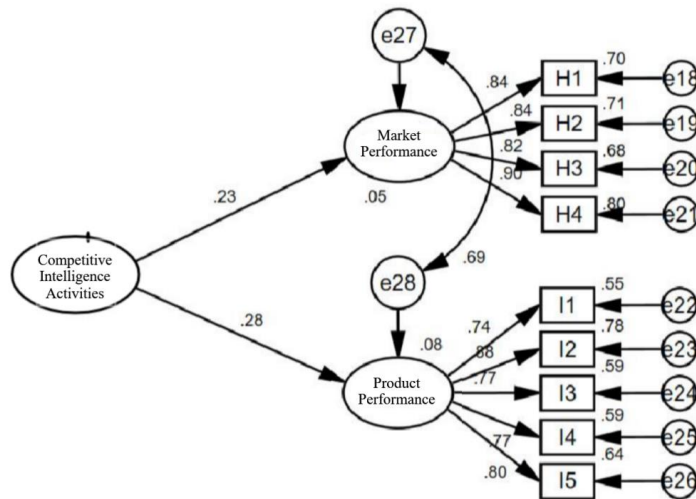
CREATION	E2	0.766	0.733	
	E3	0.699	0.798	
KNOWLEDGE UTILIZATION	F1	0.686	0.827	0.850
	F2	0.719	0.797	
	F3	0.764	0.747	
INOVATIVE ABILITY OF KNOWLEDGE EMPLOYEES	G1	0.757	0.850	0.883
	G2	0.758	0.850	
	G3	0.809	0.801	
MARKET PERFORMANCE	H1	0.812	0.906	0.924
	H2	0.857	0.892	
	H3	0.794	0.912	
	H4	0.844	0.897	
PRODUCTS PERFORMANCE	I1	0.678	0.861	0.878
	I2	0.819	0.826	
	I3	0.662	0.863	
	I4	0.652	0.866	
	I5	0.747	0.843	

A crucial part of empirical analysis is validity analysis. By using measurement tools, time and cost can be saved, such as in surveys. Regarding questionnaires, content validity and construct validity are usually used for measurement. Among them, the appropriateness and logic of the test items and the measured variables are the content validity (Lu et al., 2006). The questionnaire used in this study is based on a review of the literature to determine the relationship or correlation between variables, and based on the results of the pre-test, further revisions and improvements were made to the wording and expression of the test items, so it can be considered that the scale has satisfactory content validity. The focus of this study is to investigate construct validity, which refers to the ability of a question item to measure the variable being measured (Cai & Yi, 2019). To test the structural validity of the scale, exploratory factor analysis (EFA) is conducted using the data collected from this study. Ma (2002) pointed out that validity is composed of three elements: content validity, construct validity and criterion-related validity. As far as the actual situation of the study is concerned, this study mainly considers the indicator of construct validity. This study adopts the factor analysis method. In order to judge whether the data in this study are suitable for factor analysis, this paper refers to the KMO index and the results of Bartlett's test.

## Findings

### Testing the Effect of Competitive Intelligence Activities on Innovation Performance

This study uses competitive intelligence activities as the independent variable and market performance and product performance as the dependent variables for structural equation model testing, through the processes of model setting, model identification, model estimation, and model testing; the latter model uses an econometric model to test the proposed theoretical hypotheses, and the results of the study are shown in Figure 4.2.



**Figure 4-1 Analysis of the Impact of Competitive Intelligence Activities on Innovation Performance**

The maximum likelihood method was used to estimate the model shown in Figure 4-2, and the number of endogenous measurable variables  $q$  is 11. Among the parameters to be estimated, there are 10 path coefficients, 1 covariance between the latent variables, and 14 variances of the error terms, for a total of 25. According to the t-rule of model identification, the number of parameters of the model  $t=25 \leq 66$ , and the degree of freedom=41, the model is over-identified, so the model parameters can be estimated and the goodness of fit can be tested. The model fit indices of the factors are presented in Table 4-14. From the table, it can be seen that the structural equation model fit indices are  $\chi^2/df=2.034$ ,  $GFI=0.964$ ,  $AGFI=0.942$ ,  $RMSEA=0.051$ ,  $NFI=0.968$ ,  $TLI=0.978$ ,  $CFI=0.984$ , which all meet the good model fitting test standards. Therefore, the model fitting of the structural equation model is good.

**Table 4-4 Fit Index for Structural Equation Model of Competitive Intelligence Activities on Innovation Performance**

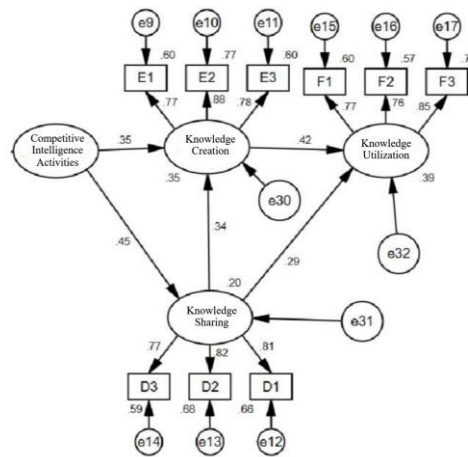
TEST STATISTIC	REFERENCE STANDARDS	VALUE	FITTING SITUATION
$C^2$		83.380	
DF		41	
$\chi^2/DF$	1-3	2.034	Yes
GFI	$\geq 0.90$	0.964	Yes
AGFI	$\geq 0.90$	0.942	Yes
RMSEA	$\leq 0.08$	0.051	Yes
NFI	$\geq 0.90$	0.968	Yes
TLI	$\geq 0.90$	0.978	Yes
CFI	$\geq 0.90$	0.984	Yes

The results of this study are shown in the following table. The results show that competitive intelligence activities have a significant positive impact on market performance ( $\beta=0.226$ ,  $P < 0.001$ ), supporting hypopaper H1a: Competitive intelligence activities have a positive impact on market performance. Competitive intelligence activities also have a significant positive impact on product performance ( $\beta=0.279$ ,  $P < 0.001$ ), supporting hypopaper H1b: Competitive intelligence activities have a positive impact on product performance.

**Testing the Effect of Competitive Intelligence Activities on Knowledge Management**

This study uses competitive intelligence activities as the independent variable, knowledge sharing and knowledge creation as mediator variables, and knowledge utilization as the

dependent variable to conduct structural equation model testing, through the processes of model setting, model identification, model estimation, and model testing; the latter model uses an econometric model to test the proposed theoretical hypotheses, and the results of the study are shown in Figure 4-3.



**Figure 4-2 Analysis of the Impact of Competitive Intelligence Activities on Knowledge Management**

The maximum likelihood estimation method was used to estimate the model shown in Figure 4-3, and the number of endogenous measurable variables  $q$  is 11. Among the parameters to be estimated, there are 12 path coefficients, 0 covariances between the latent variables, and 15 variances of the error terms, for a total of 27. According to the t-rule of model identification, the number of parameters of the model  $t=21 \leq 66$ , and the degree of freedom=39, the model is over-identified, so the model parameters can be estimated, and the goodness of fit can be tested.

**Model fit index**

Table 4-16 shows the model fit indices for the factor analysis. From the table, it can be seen that the structural equation model fit indices are  $\chi^2/df=1.048$ ,  $GFI=0.982$ ,  $AGFI=0.969$ ,  $RMSEA=0.011$ ,  $NFI=0.980$ ,  $TLI=0.999$ ,  $CFI=0.999$ , which all meet the good model fitting test standards. Therefore, the model fitting of the structural equation model is good.

**Table 4-5 Fit Index for Structural Equation Model of Competitive Intelligence Activities on Knowledge Management**

TEST STATISTIC	REFERENCE STANDARDS	VALUE	FITTING SITUATION
<b>C<sup>2</sup></b>		0.875	
<b>DF</b>		39	
<b>X<sup>2</sup>/ DF</b>	1-3	1.048	Yes
<b>GFI</b>	≥0.90	0.982	Yes
<b>AGFI</b>	≥0.90	0.969	Yes
<b>RMSEA</b>	≤0.08	0.011	Yes
<b>NFI</b>	≥0.90	0.980	Yes
<b>TLI</b>	≥0.90	0.999	Yes
<b>CFI</b>	≥0.90	0.999	Yes

The results of this study are shown in the following table. The results show that competitive intelligence activities have a significant positive impact on knowledge sharing ( $\beta=0.452$ ,  $P < 0.001$ ), competitive intelligence has a significant positive impact on knowledge creation ( $\beta=0.352$ ,  $P < 0.001$ ), knowledge sharing has a significant positive impact on knowledge

creation ( $\beta=0.344$ ,  $P < 0.001$ ), knowledge creation has a significant positive impact on knowledge utilization ( $\beta=0.425$ ,  $P < 0.001$ ), and knowledge sharing has a significant positive impact on knowledge utilization ( $\beta=0.295$ ,  $P < 0.001$ ).

## Conclusion

This study explores in depth the relationship and mechanism of action of competitive intelligence activities, knowledge management processes, innovative capabilities of knowledge employees, and innovation performance of small and medium-sized technological enterprises. (Deng & Ye 2020; Fang 2020). The empirical results show that the hypotheses are all supported. In this section, the findings will be discussed in six aspects: the impact of competitive intelligence activities on innovation performance of technology-based SMEs, the impact of competitive intelligence activities on knowledge management process, the internal influence mechanism of knowledge management process, the impact of knowledge management process on innovation performance of technology-based SMEs, the mediating role of knowledge management process, and the mode Regarding the impact of competitive intelligence activities on the innovation performance of small and medium-sized technological enterprises, this study proposes two hypotheses: Hypopaper H1a: Competitive intelligence activities have a significant positive impact on the market performance of small and medium-sized technological enterprises; Hypopaper H1b: Competitive intelligence activities have a significant positive impact on the product performance of small and medium-sized technological enterprises. Both two hypotheses are supported, which is consistent with the research findings of Zhao et al. (2016) and Kang et al. (2017) on the promotion of innovation performance of small and medium-sized technological enterprises through competitive intelligence activities. This conclusion is a supplement and extension of the related results of competitive intelligence activities and innovation performance of small and medium-sized technological enterprises, enriching the resource-based theory. Undoubtedly, this study analyzes the internal logic of competitive intelligence activities, knowledge management processes and innovation performance of small and medium technological enterprises, providing a scientific basis for more scientifically and effectively increasing enterprise value. Second, this study also has important practical guidance value and enlightening significance for small and medium-sized technological enterprises and enterprise employees. (Chen et al. 2017; Deng & Ye 2020; Fang 2020; Zhu et al. 2020; Zhan & Wang 2020; Zhang et al. 2020; Yu et al. 2020).

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