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KNOWLEDGE MANAGEMENT IMPACTS ON ORGANIZATIONAL INNOVATION PERFORMANCE

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Abstract. *Today the core competence of an organization has increasingly relied on the usage and innovation of knowledge. Based on a clear classification of the four knowledge management dimensions, knowledge management strategy, organization and culture, intellectual capital and knowledge sharing, this article did an empirical research of introducing employee innovation performance into the impact mechanism model between knowledge management and organization innovation performance.*
Keywords: Knowledge management, Innovation performance, Structural equation model

1. **Introduction.** In modern knowledge economy, the core competence of the organization has been increasingly relied on the usage and innovation of knowledge. Without knowledge management (KM), enterprises cannot achieve competitive advantages in modern market [1]. However, in practical fields, there are few domestic applications of KM, especially on the innovation performance (IP). In academic fields, there has not been a widely approved definition of KM. KM implementation process requires the suitable organization structure, while IP emerges from the organization's marginal side [2]. This article verified the KM dimensions, such as knowledge management strategy (KMS), organizational culture (OC), knowledge sharing (KS), and intellectual capital (IC), by doing an empirical research of introducing employee innovation performance (EIP) into the impact mechanism model between KM and organization innovation performance (OIP), and thus opened the black box of the way how KM influences OIP.

In the following parts, this article will firstly make a measurement scale of KM and assume a structure between KM and IP in the second part; then by doing an empirical study, it can be verified in the third part that the measuring items are of good validity and consistency; at the same time, the model of KM and IP can be confirmed by the structural equations; finally, a conclusion is made in the fourth part that to improve OIP, it is required not only emphasizing the direct influence of KM, but also underlining the indirect effect from EIP.

2. **Model Building and Hypothesis.** To figure out the impact mechanism of KM towards OIP, we will firstly analyze internal composition and influencing factors on KM and OIP, forming interconnected networks of KM-OIP framework. Then determine the possible impact of EIP on the whole system, so as to make clear connotations of KM, EIP, and OIP, among which OIP contains organization technical innovation (OTI) and organization management innovation (OMI) (Figure 1).

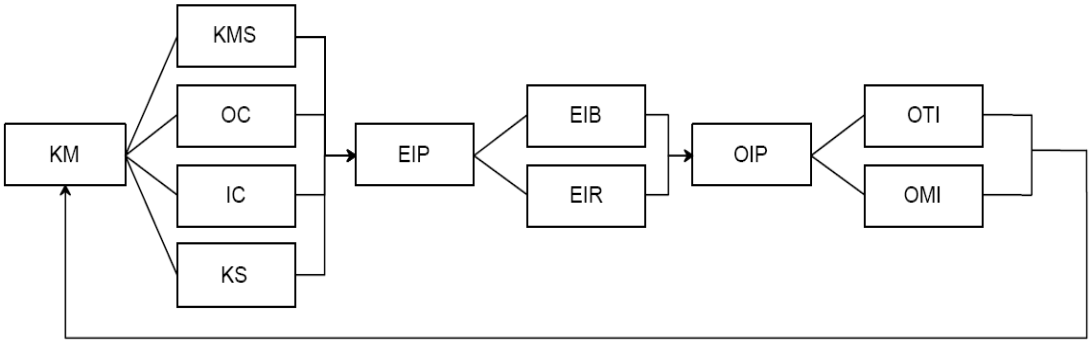

FIGURE 1. Theoretical model of KM-OIP

2.1. **Dimension dividing and measuring items.** In practice, KM is a dynamic and continuous organizational phenomenon. It requires a structure to contain its content, which KM system works for. Basically, KM system is to support creation, transfer, and application of knowledge. KM involves unique and interconnected processes of knowledge creation, knowledge storage and retrieval, knowledge transfer, and knowledge application [3]. If we regard knowledge as a special resource, then KM process concludes acquisition, sharing, and application [4].

Knowledge, as a kind of resource, can be defined in different ways. When it is used for marketing decision, knowledge comes from retailers, market research and third-party data providers [5]. In this view, knowledge overlap in technological mergers and acquisitions is essential for improving IP [6]. Mangiarotti and Mention divided KMS into two aspects, and they evaluated the impact of codification and personalization strategies, both individually and jointly, distinguishing between innovation propensity and innovation output [7]. When it comes to personalization strategies, individuals who own intangible active stocks play a vital role in improving IP [1]. On the other side, KMS, by drawing on various IT tools and capabilities, can play various roles in KM processes [3]. Thus, we measured KMS in four items: codability, individualization, IT ability, knowledgeable human resource. Among the factors that form knowledge management, knowledge management strategy is the one which has a significant relation with firm outcome [2].

Explicating tacit knowledge to explicit knowledge makes it possible for members to share their knowledge [5]. In this way, teams produce knowledge innovation product more frequently than individuals do, which shows that KS positively affects IP [8]. By launching knowledge management initiatives, the deciders motivate institution members efficiently [5]. This article divided the measurement questions in five factors: dominant knowledge, recessive knowledge, motivation, deciders' attitude, knowledge absorbing capacity.

Individuals all work in special environment. In an enterprise, the levers of motivation are more effective in creating value when used in an appropriate cultural setting [9]. A suitable competitive context creates a good culture, which finally improves the firm's EIP [10]. The three factors, culture, levers of worker motivation, and value in a configurational approach, are interdependent with each other closely [2]. According to Zheng and Si [11], we measured OC as follows: oblate organization, team structure mode construction, innovative failure mechanism of tolerance, staff awards program.

Knowledge management can be defined not only from KS and OC aspects, but also from IC. When it comes to national economical efficiency, there is a tight relationship between human capital and economic growth [12]. Intellectual capital has a positive impact on firm's output, and indicates future performance well [13]. Human capital has a positive linear relation with innovation [14]. Thus, as one kind of knowledge resources, intellectual capital affects IP directly. Human resources are valuable assets for organizations [3], and

it plays a crucial role of knowledge managing capacity. IC influences OIP internally and externally, by the effects of human, technological, and vertical social capital [15]. This article divided IC into four factors: human capital, structural capital, external social capital, and internal social capital.

Based on the studies by Scurtu and Neamtu [1], Chen and Huang [4], this article defined KM as a management activity aiming to improve the creation and flexibility of the organization, and divided it into four dimensions: KMS, OC, IC, and KS.

This article was based on the resource basis theory punished by Wernerfelt [16] in 1984. The basis hypotheses are as follows: organization contains special resource which can transfer unique capacity in both tangible and intangible ways; the resource in different organization is heterogeneous; the organization competitive advantage stems from the organization's unique resource, which brings economic benefit to its home. We can then get the hypothesis in our knowledge management field: organization contains special knowledge which can transfer unique capacity in both explicit and tacit ways; different kinds of knowledge can be interconnected into the special capacity of the organization, and appear as OIP; IP is the source of the organization competitive power. And if subdivided further, IP can be divided into firm and staff level. In the firm level, OIP can be divided into technical and management innovation. Technical innovation focuses on the efficiency analysis from the view of economy, shown as specific economic efficiency, and using microscopic method, while management innovation focuses on the macroscopic method, which analyzes the improvement of innovative capacity caused by knowledge management.

In the market environment, IP contains three metrics: product and service innovations, process innovation, and marketing innovation [15]. Employee innovation behavior contains four factors: innovation will, innovation scheme, new technical application, and assumption of work tips [17]. This article measured employee innovation result from innovative effect and innovative application. This article measured technological innovation by new technical application and product innovation, and divided management innovation into three factors: organizational efficiency, organizational creativity, and problem-solving ability [18].

You can see the clear measurement questions of all above in Table 1. Using the Richter magnitude scale, this article designed a questionnaire which contains 28 question items.

2.2. **Hypothesis.** The EIP impact is added to the KM-OIP relationship, and the EIP acts on the entire system through EIB and EIR. EIB and EIR also act on OTI and OMI in KM, and KMS, OC, IC, KS in OPI. Assume that the theoretical model (Figure 2) indicates that there may be positive relationships in each connection line.

First, there is the relationship between KM and OIP. According to former literature review, we have the hypotheses.

H1: KMS is in positive correlation with OTI. H2: KMS is in positive correlation with OMI.

KM implementation requires a cultural structure. An enterprise without OC can be easily affected by the external networks, especially the IP [19]. Thus, we have the hypotheses.

H3: OC is in positive correlation with OTI. H4: OC is in positive correlation with OMI.

IC is expected to have a positive influence on firm performance [20]. Furthermore, it can indicate future projects' performance [20]. Thus, we have the hypotheses.

H5: IC is in positive correlation with OTI. H6: IC is in positive correlation with OMI.

A high quality of overlapped knowledge has effects on IP positively. Besides, there is a curvilinear relationship between 'openness' and IP [15]. Thus, we have the hypotheses.

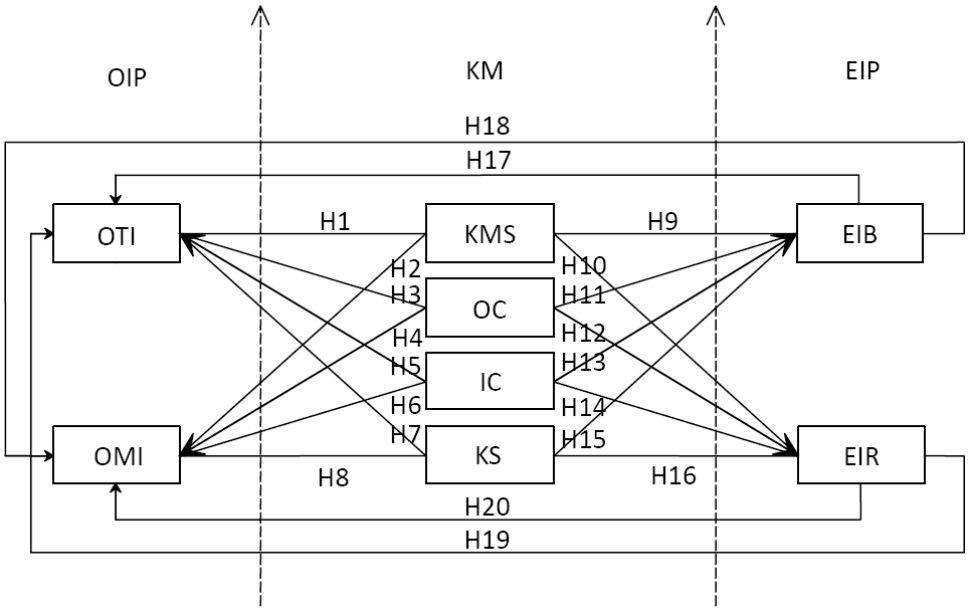

FIGURE 2. Hypothetical model

H7: KS is in positive correlation with OTI. H8: KS is in positive correlation with OMI.

Second, there is a relationship between KM and EIP. KMS motivates EIB, while EIR contributes to the KMS making. Thus, we have the hypotheses.

H9: KMS is in positive correlation with employee innovation behavior (EIB).

H10: KMS is in positive correlation with employee innovation result (EIR).

From the view of social psychology, fine culture background stimulates EIB, while EIR interacts with the cultural construction. Thus, we have the hypotheses.

H11: OC is in positive correlation with EIB. H12: OC is in positive correlation with EIR.

EIP depends on the collection, sharing, and operation of organizational IC. And IC needs to be shown through employee performance. Thus, we have the hypotheses.

H13: IC is in positive correlation with EIB. H14: IC is in positive correlation with EIR.

The intangible knowledge of each person, only through sharing, can achieve innovation. And it finally appears as EIB and EIR. Thus, we have the hypotheses.

H15: KS is in positive correlation with EIB. H16: KS is in positive correlation with EIR.

Third, there is a relationship between EIP and OIP. The interior EIB comes from each employee's technique, which finally leads to OIP. Thus, we have the hypotheses.

H17: EIB is in positive correlation with OTI. H18: EIB is in positive correlation with OMI.

H19: EIR is in positive correlation with OTI. H20: EIR is in positive correlation with OMI.

3. **Empirical Study.**

3.1. **Data analysis.** This article collected 30 organizations from enterprises, universities, and government departments in Liaoning Province, and totally sent 360 questionnaires. After a filtration of invalid questionnaires, there were 260 slices, and the recovery was 72.2%. Mostly, the interviewees' education status is higher than undergraduate. According to available data, knowledge-intensive members are almost between 21 and 35 years old, mostly postgraduate. Thus, the samples are suitable for this study.

3.2. **Validity and reliability.** The analysis of how to choose measuring items has been discussed before, all according to the current achievements and maturity scales. This article analyzed the validity and reliability by using SPSS 22.0, and finally got a good result with all the Cronbach's $\alpha > 0.667$, and every single CITC > 0.5. It can be seen from Table 1.

TABLE 1. The reliability analysis results of model variables

Variable	Item code	Measuring item	CITC	Alpha if Item Deleted	Cronbach's α
KMS	KM1	Codability	0.619	0.728	0.790
	KM2	Individualization	0.739	0.663	
	KM3	IT ability	0.545	0.765	
	KM4	Knowledgeable human resource	0.506	0.781	
OC	OC1	Oblate organization	0.581	0.654	0.731
	OC2	Team structure mode construction	0.586	0.689	
	OC3	Innovative failure mechanism of tolerance	0.567	0.695	
	OC4	Staff awards program	0.521	0.673	
IC	IC1	Human capital	0.508	0.731	0.737
	IC2	Structural capital	0.544	0.711	
	IC3	External social capital	0.602	0.652	
	IC4	Internal social capital	0.563	0.724	
KS	KS1	Dominant knowledge	0.564	0.666	0.699
	KS2	Recessive knowledge	0.596	0.693	
	KS3	Motivation	0.603	0.735	
	KS4	Deciders' attitude	0.556	0.687	
	KS5	Knowledge absorbing capacity	0.521	0.643	
EIB	EIB1	Innovation will	0.745	0.734	0.736
	EIB2	Innovation scheme	0.675	0.639	
	EIB3	New technical application	0.602	0.628	
	EIB4	Assumption of work tips	0.578	0.613	
EIR	EIR1	Innovative effect	0.623	0.698	0.678
	EIR2	Innovative application	0.534	0.680	
OTI	OTI1	New technical application	0.689	0.619	0.703
	OTI2	Product innovation	0.695	0.602	
OMI	OMI1	Organizational efficiency	0.759	0.697	0.698
	OMI2	Organizational creativity	0.723	0.643	
	OMI3	Problem-solving ability	0.673	0.545	

3.3. **Model verification.** Structural equation model is a technique of solving simultaneous equations, which contains two measuring and one structural equations with the former two focusing on external relationship while the latter one focusing on internal relationship:

$$y = \Delta y\eta + \varepsilon y, \tag{1}$$

$$x = \Delta x\xi + \varepsilon x, \tag{2}$$

$$\eta = B\eta + \Gamma\xi + \zeta. \tag{3}$$

The four dimensions of KM can be considered as four external variables ξ_i $(i = 1, 2, 3, 4)$. The influencing factors of KMS, ξ_1, the first dimension, are codability x_1, individualization x_2, IT ability x_3, knowledgeable human resource x_4, which all form together as a load matrix Δx. All the four dimensions, KMS ξ_1, OC ξ_2, IC ξ_3, KS ξ_4, form an external LV matrix ξ. We get the measuring equation $x = \Delta x\xi + \varepsilon x$ (ε is residual error). In the similar way, we get the two endogenous variables of OIP, technical and management innovation, as η_1 and η_2. For the former one η_1, it has two influencing factors, new technical application and product innovation as y_1, y_2, which together form a load matrix Δy. We get the measuring equation, $y = \Delta y\eta + \varepsilon y$. The internal LV matrix μ is in direct proportion with the path coefficient matrices B and Γ with a permissible error, ζ. We get the structural equation $\eta = B\eta + \Gamma\xi + \zeta$. The whole model is as shown in Figure 3.

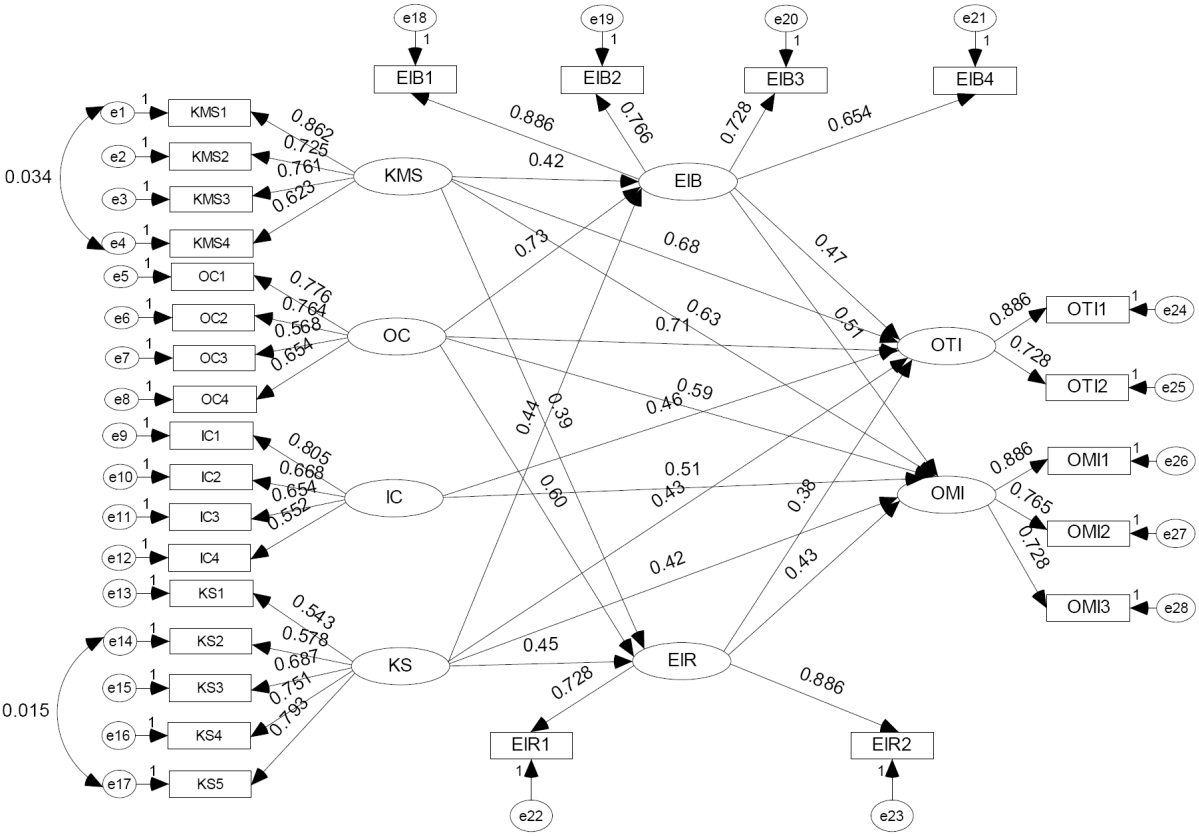

FIGURE 3. Analysis of structural equation model after correction

We used Bootstrap tool to make the path analysis of the mode. After setting 1500 Bootstrap samples, making repeated iterative operation, and being astringed in 25 times, the mode is well collocated in 824 samples, while 272 samples are not well collocated. The significance probability is 0.094, which means the mode is acceptable. Then it is needed to modify the initial model by using AMOS17.0 tool, and basically adjust the covariant relationships between KMS1 and KMS4, KS2 and KS5.

After this, all the indexes have reached the standard, and the structural equation model is well collocated with samples. After the model operation, we got a table as Table 3.

We accept the assumption if P value < 0.05. The table above shows 18 assumptions passed, while the assumption H13 and H14 nonsupport. According to Figure 1, Table

TABLE 2. The results of confirmatory factor analysis

Designation	$\chi 2/df$	GFI	RMSEA	RMR	NNFI	IFI	CFI
Model	2.380	0.940	0.389	0.035	0.940	0.950	0.950
Critical value	< 3	> 0.90	< 0.08	< 0.05	> 0.90	> 0.90	> 0.90

TABLE 3. Parametric bootstrap estimation and testing hypothesis based on structural equation model

Hypothesis	Standardized path coefficient	P value	Results
H1	0.68	< 0.001	Support
H2	0.63	0.041	Support
H3	0.71	0.019	Support
H4	0.59	0.020	Support
H5	0.46	0.036	Support
H6	0.51	0.025	Support
H7	0.43	0.031	Support
H8	0.42	0.033	Support
H9	0.42	0.021	Support
H10	0.39	0.043	Support
H11	0.73	< 0.001	Support
H12	0.60	< 0.001	Support
H13	0.21	0.206	Nonsupport
H14	0.37	0.087	Nonsupport
H15	0.44	0.012	Support
H16	0.45	0.024	Support
H17	0.47	0.046	Support
H18	0.51	0.038	Support
H19	0.38	0.027	Support
H20	0.43	< 0.001	Support

3, and the intermediary variable inspection mechanism, we see that KM directly affects OIP, in which KMS has the strongest influence. After introducing EIP, KM influences OIP indirectly through EIP. EIP has a strong mediate function.

The results above indicate several points. To begin with, KMS directly influences OIP. The driving function which KMS acts on OIP reaches at 0.68, which illustrates the main factors, such as codability, individualization, IT ability and knowledgeable human resource all affect OTI. Thus, organizations can achieve technical innovation by establishing the interior codability, cultivating employees' IT ability, as well as enhancing knowledgeable human resource management. Furthermore, OC directly influences EIP, which straightly acts on EIB at the rate of 0.73, and 0.60 on EIP. This manifests that the factors including oblate organization, team structure mode construction, innovative failure mechanism of tolerance and staff awards program are good for the dissemination, sharing and innovation of inner knowledge. To achieve the EIP, organizations ought to pay close attention to cultural fit. Besides, as is mentioned above, employees' behavior is basically supported by organization technology. EIB has a significant effect on OIP. Last but not least, the nonsupport of H13 and H14 indicates that intellectual capital only influences OIP, while it has tiny influence on EIP. The exterior information and knowledge which are absorbed from outside surroundings fail to internalize as employees' innovation.

4. **Conclusion.** In this paper, 260 effective questionnaires from 30 enterprises and organizations in Liaoning Province were used to demonstrate how KM could influence OIP on the support of KMS, OC, KS and IC. At the same time, the research innovatively introduced EIP. By introducing EIP in the influence mechanism between KM and OIP through empirical analysis, we can draw the following conclusion.

The empirical study on the influence of KM on OIP has passed the significance test. Among them, KMS has the greatest influence on OIP in the factors that make up KM, which fully demonstrates the role of KMS as the media platform of knowledge sharing. In management field, managers ought to attach importance to KMS. The basic construction of the infrastructure facilities, like codability, individualization, IT ability and knowledgeable human resource is vital to foster OIP.

Secondly, the introduction of EIP into the influencing mechanism between KM and OIP expands the micro-mechanism in the individual level, which provides a new possibility for OIP improvement. The results of the study show that to improve OIP, it is required not only emphasizing the direct influence of KM, but also underlining the indirect effect from EIP.

There are two future research prospects: the nonsupport of the assumptions between IC and EIP indicates that the knowledge which organizations absorb from the external environment fails to convert into EIP, and it remains to be seen what exactly hinders the conversion; the result would be much more canonical, if the empirical data were based on data mining technology, instead of questionnaire.

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