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Knowledge-Intensive Enterprise Systems (KES): A Novel Concept

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ABSTRACT

Although plenty of studies have discussed the positive impact of Knowledge Management (KM) and Enterprise Resource Planning (ERP) systems on each other, no study has demonstrated the mutual interaction between these two well-known concepts. Implementation of ERP systems, as the best representative of Enterprise Systems (ES), is a continuous improvement effort which needs to have KM embedded in its phases. On the other hand, KM phases cannot be accomplished without usage of ES infrastructure. Therefore, since KM and ES seem to be inseparable, in this study it is tried to introduce a novel concept, i.e. Knowledge-intensive Enterprise Systems (KES), which is actually a blend of KM and ES. The study takes place in two primary steps. In the first step, the supporting interaction among KM and ERP systems is demonstrated through real data of a case study. And in the second step, the KES model is proposed by application of factor analysis to the same data.

KEYWORDS: Enterprise Resource Planning, Enterprise Systems, Knowledge Management, KM-ES interaction.

1. INTRODUCTION

A lot of studies in the literature are conducted in order to investigate the relationship between Knowledge Management (KM) and Enterprise Resource Planning (ERP) systems. It should be noted that ERP systems can be considered as the best representative of Enterprise Systems (ES). As is demonstrated in Table 1, almost all of these studies have focused on the effect of one concept on the other and none of them has directly mentioned the mutually-supporting interaction between KM and ERP systems. However, ERP implementation is a continuous improvement effort which needs KM to be embedded in its every single phase to prosper [18]. Similarly, in order to be implemented, KM urgently needs the IT capabilities of ES. All phases of KM like knowledge transfer and knowledge retention take place through utilization of ES infrastructures like intranets and portals.

It is absolutely rational to merge the concepts of KM and ES, since none of them can be thoroughly implemented and employed in the absence of the other one. Therefore, in this study, it is tried to introduce a novel concept namely Knowledge-intensive Enterprise Systems (KES) which is a blend of KM and ES. In this regard, firstly, the supportive interaction between KM and ES is demonstrated through the real data of a case study, and secondly, factor analysis is applied to the same data to gain a clear classification of the KES components. To put it simply, this study comprises two main steps: (1) proving the supporting interaction between KM and ERP systems and (2) extraction of the KES model.

Table1. Studies on relationship between KM and ERP

Source \ Type of relationship	KM supporting ERP	ERP supporting KM	KM-ERP interaction
Chan et al. [3]		✓	---
Li and Zhao [14]	✓		---
Li et al. [15]	✓		---
McGinnis and Huang [18]	✓		---
Metaxiotis [19]		✓	---
O'Leary [24]	✓		---
Parry and Graves [25]		✓	---
Sedera and Gable [28]	✓		---
Tsai et al. [33]	✓		---
Vandaei [37]	✓		---

The literature lacks a study demonstrating the supportive relationship between Knowledge Management (KM) and Enterprise Systems (ES). Besides, to take advantage of KM and ES capabilities, they should be implemented in an organization simultaneously. On the one hand, KM urgently needs IT infrastructure of ES to have its cyclic phases accomplished; on the other hand, ES implementation, considered as a continuous improvement effort, should embody KM to have the opportunity of prospering. To put it simply, it is not possible to have each one without having the other one; therefore, it sounds logical to integrate KM and ES.

In this study, two steps are taken to fill these gaps. In other words, the scientific contributions of this paper are: 1) supporting relationship between ERP systems, as the best representative of ES, and KM are demonstrated through utilization of real data of a case study. And, 2) a model is derived from the same data for a novel concept i.e. Knowledge-intensive

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Enterprise Systems (KES). As stated above, since KM and ES seem inseparable, the concept of KES is trying to present a blend of them to let organizations derive the optimum benefit.

The remainder of this study was organized as follows: in section II, the KM and ERP systems as the theoretical background are depicted. Then, in section III, KM-ERP interaction is discussed. Two hypotheses of this study are also proposed in this section. Section IVessentially encompasses the methodology. The findings of the first step of the study are discussed in section V. The second step of the study has taken place in section VI whereby the Knowledge-intensive Enterprise System is proposed. All the eight factors of KES are also explained in this section. Finally, in section VII,the paper conclusionis presented.

2. Theoretical Background

2.1.Knowledge Management(KM)

Knowledge Management has attracted a lot of interest from scholars in the last two decades [7, 19, 26, 37, 38]. Knowledge exploitation, leading to innovation, enables organizations to gain competitive advantage over their competitors in an unstable business environment.Knowledge can be viewed as firm capability [13]. Due to the fact that duplication of this knowledge is so hard for others, the achieved superiority is sustainable. Organizations can solve problems and take opportunities by managing knowledge [27]. This function will create new abilities and it will increase innovation [30].In fact, as Francis Bacon has stated, “knowledge is power” [16]. Knowledge Management is related to some cultural changes in a broader context, with the aim of switching people’s attitude from “my knowledge is power” to “sharing knowledge is power” [27]. In the literature, many definitions can be found for Knowledge Management. As stated by Hibbard [6], Knowledge Management is “the process ofcapturing the collective expertise of the organization from different sources (i.e. databases, paper, people) and utilizing that knowledgebase to leverage the organization”. According to Davenport and Prusak [4], “Knowledge management is concerned with the exploitation and development of the knowledge assets of an organization with a view to furthering the organisation’s objectives”. It is the necessity of the knowledge organizations [31].Kamaraet al. [8] also introduced KM as “the organizational optimization of knowledge to achieve enhanced performance through the use of various methods and techniques”. Generally speaking, KM can be regarded as a systematic process consisting of some phases to manage a combination of knowledge, information, and data with the purpose of linking people who need to know to the knowledge of right ones in a timely manner [20, 23, 24, 28, 37]. Knowledge Management is defined as the task of developing and exploiting an organization’s tangible and intangible knowledge resources [32].As Sedera and Gable [28] discussed, four primary phases that can be considered for Knowledge Management with regard to the literature on KM processes are: (1) Creation, (2) Retention, (3) Transfer, and (4) Application.

2.2. Enterprise Resource Planning(ERP)

Businesses used to maintain stand-alone information systems supporting certain business functions like production, human resources, and marketing. Therefore, after a while they started losing their competitive advantage due to the lack of communication and integration between business functions [5]. Information Technology can be used as an important tool for enhancing organization’s performance [21]. One the information technology solution is Enterprise Resource Planning(ERP).Hence, in order to remain competitive, businesses stepped towards implementing Enterprise Resource Planning systems [17, 39]. ERP systems, deriving benefit from a central database and a common platform, are business management systems which integrate a set of modules embodying financial and accounting, manufacturing, sales and distribution, human resources, supply chain, and customer information [9, 11, 12, 40]. In today’s business environment, businesses have to share their knowledge widely not only in their own departments but also with their suppliers, distributors, and customers [2, 10, 19, 29, 33, 36, 37]. ERP systems benefit businesses in different ways like declines in inventory, working capital reduction, and sufficient information concerning customer needs; however, according to Umble [36], they provide two main benefits that is not possible for non-integrated systems to provide: “a unified enterprise view of the business that encompasses all functions and departments; and, an enterprise database where all business transactions are entered, recorded, processed, monitored, and reported”.

3. KM-ES Interaction

In this study, ERP systems are designated as the best representative of ES. As McGinnis and Huang [18] have argued, ERP implementation should be considered as a continuous improvement effort that embodies an initial ERP implementation as well as some successive post-implementation projects. To make ERP systems boost, KM must be embedded in every single phase of this process. According to the literature on ERP implementation [18, 24, 28, 34, 37], KM is a great tool for supporting ERP systems. Conducting an empirical research, Sedera and Gable [28] demonstrated the positive correlation between KM-competence and ES-success. With respect to the literature on KM phases, they accepted creation, retention, transfer, and application as the four primary phases which constitute KM-competence. They also considered four dimensions for ES-success i.e. Individual-Impact, Organizational-Impact, System-Quality, and Information-Quality. The findings of their study imply that improvement in any or all of the KM-competence phases will lead organizations to improved levels of ES-success.In addition,

by provision of functional integration and augmented control of data, information, and knowledge.In the organization, ERP systems as IT tools facilitate managing knowledge [3, 19, 37]. Every phase of KM can be facilitated by electronic repositories, information retrieval mechanisms, and technologies for knowledge sharing of ERP systems. All in all, ERP systems can promote KM capabilities as a whole [1].Fig. 1 shows this interaction.

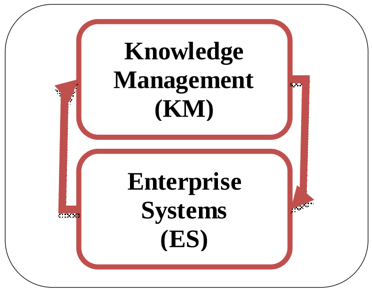

Fig. 1.KM-ES interaction

Hypothesis 1: KM affects ES systems positively.

Hypothesis 2: ES system affects KM positively.

4. THE METHOD

This study has employed a survey research method to examine the hypothesized relationships among KM and ERP systems.

4.1. Sample

The sample is an Iranian industrial and construction company which has implemented KM and an ERP system. The respondents are mainly experts or core members in the management team or chief managers who have good understanding of the company's performance. A researcher involved in the study personally delivered 128 questionnaires to the respondents. One hundred and four questionnaires were returned with a response rate of 81.25%. Among the returned questionnaires, 7 questionnaires were evaluated incomplete and consequently eliminated. Finally, 97 valid questionnaires were collected with a validity rate of 75.78%.

4.2. Measures

The measurement of the analysis variables has been built on a multiple-items method, which increases confidence about the accuracy and consistency of the assessment. Each item was based on a five point Likert scale and all of them are perceptual variables. Table 2 depicts items used in the study.

This study measures ERP with 18 items. Each item corresponds to each critical success factor of ERP. As Ngai et al. [22] have expressed, a comprehensive ERP critical success factor framework comprises appropriate business and IT legacy systems; business plan/vision/goals/justification; business process reengineering; change management culture and programme; communication; data management; ERP strategy and implementation methodology; ERP teamwork and composition; ERP vendor; monitoring and evaluation of performance; organizational characteristics; project champion; project management; software development, testing, and troubleshooting; top management support; fit between ERP and business/process; and, national culture and Country-related functional requirements.

In order to measure KM, 30 items were measured. Based on Tseng [35], all items are divided into three main parts, namely, KM strategy items, the plan of KM items, and the implementation of KM plan items.

4.3. RESULTS

The suitability of each inter-correlation matrix for factor analysis was determined by Kaiser-Meyer-Olkin statistics (KMO) Measure of Sampling Adequacy (MSA).Significance of the variables for factor analysis should be evaluated prior to such an analysis. KMO measure of sampling adequacyis a statistic to evaluate the significance of variables for this purpose. When the value of this statistic is higher than 0.7, the existing correlation is appropriate for factor analysis. If it is in a range between 0.5 and 0.69, more care should be taken to achieve at an accurate analysis. And, when the value is lower than 0.5, the correlation does not suit factor analysis. Indeed, value should be greater than 0.6 for a satisfactory factor analysis to proceed. The SPSS output for KMO statistic in this study is presented in Table 2.

Table 2. Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (MSA) and Bartlett's test of Sphericity for the inter-correlation matrix of the empirical dimensions

Factors		ERP	KM
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.697	0.713
Bartlett's Test of Sphericity	Approx. Chi-Square	1599.909	3914.228
	df	153	435
	Sig.	0.000	0.000

As shown in Table 2, the results of this procedure generated KMOs of 0.697 for ERP and 0.713 for KM, while the corresponding Bartlett's test of Sphericityindicated a significant correlation among variables. The high chi-square value associated with a low p-value ($p < 0.01$) indicated significant relationships.

In the next step factor analysis was carried out. Tables 3 and 4 show the number of factors extracted for every questionnaire.

Table3.Exploratory Factor Analysis on ERP

Measurement Items	Factor 1	Factor 2	Factor 3	Factor 4	Cronbach'α
ERP1. Success level of the company in vendor selection	0.866				0.900
ERP2. Appropriateness level of the purchased customized ERP in fulfilling the company requirements	0.738				
ERP3. Level of top management support in ERP implementation project in the company	0.712				
ERP4. Level of benefiting from a project champion in ERP implementation in the company	0.672				
ERP5. Compatibility level of the national culture with ERP implementation in the company	0.655				
ERP6. Level of the company experience in similar projects	0.631				
ERP7. Success level of the company in software development, testing and troubleshooting		0.806			0.874
ERP8. Success level of the company in teamwork in ERP implementation		0.781			
ERP9. Clarity level of the goals of the company for ERP implementation		0.725			
ERP10. Success level of the company in monitoring and evaluation performance in ERP implementation		0.664			
ERP11. Fitness level between business/processes of the company and ERP		0.635			
ERP12. Success level of the company in utilization of project management in ERP implementation			0.806		0.841
ERP13. Clarity level of the strategy of the company for ERP implementation			0.717		
ERP14. Level of correctness & accuracy of data concerning ERP implementation in the company			0.616		
ERP15. Usage level of communication for development of implementation project team in the company			0.607		
ERP16. Compatibility level of business and IT legacy systems of the company			0.575		
*ERP17. Success level of the company in business process reengineering in ERP implementation				0.798	0.395
*ERP18. Success level of the company in change management in ERP implementation				0.522	

*Item deleted during construct-level factor analysis

Table4.Exploratory Factor Analysis on KM

Measurement Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Cronbach'α
KM1. Level of the company KM ability in fulfilling the needs of an extended knowledge community	0.726								0.874
KM2. Realization level of positive influence of the obtained knowledge on the company performance	0.724								
KM3. Success level of the personnel in utilization of IT for KM implementation	0.706								
KM4. Level of truly understanding what KM means by the personnel and managers	0.628								
KM5. Level of believing that the personnel are cooperating in KM implementation instead of competing by themselves	0.523								
KM6. Alignment level of the KM goals with personal goals of the personnel		0.903							0.876
KM7. Hopefulness of the personnel about provision of enough resources to them by top managers		0.692							
KM8. Commitment level of the managers and personnel in KM implementation		0.668							
KM9. Success level of the company in provision of a knowledge repository		0.647							
KM10. Possibility level of mapping knowledge communities on the existing organizational structure			0.901						0.841
KM11. Success level of the company in provision of a prototype 1			0.712						
KM12. Usage level of a quantitative system for financial evaluation and monitoring in the company			0.615						
KM13. Commitment level of the company in provision of abundant resources to support KM			0.542						
KM14. Support level of the personnel for knowledge communities				0.844					0.857
KM15. Success level of the company in provision of user-friendly software for knowledge standardization				0.717					
KM16. Support level of the senior managers for knowledge communities				0.558					
KM17. Appropriateness of the number of levels in the hierarchical structure of the company for KM implementation				0.476					
KM18. Support level of the company knowledge management system in establishing KM strategies					0.789				0.806
KM19. Success level of the company in updating its knowledge repository					0.726				
KM20. Success level of the personnel in conveying the extracted knowledge from external sources to their managers					0.650				
KM21. Success level of the personnel in extracting useful knowledge from external sources for their company						0.800			0.778
KM22. Alignment level of the KM goals with the company goals						0.693			
KM23. Awareness of the knowledge that is critical to the company						0.678			
KM24. Support level of the current IT infrastructure of the company in KM implementation							0.706		0.839
KM25. Realization level of the barriers to implementing KM in the company by upper management							0.635		
KM26. Domination level of the company core knowledge in the industry							0.585		
KM27. Involvement level of the personnel in KM implementation							0.578		
*KM28. Ability level of the other industries in posing a threat to the company								0.832	0.287
*KM29. Success level of the company KM in provision of channels for knowledge sharing								-0.634	
*KM30. Success level of the company in provision of user-friendly hardware in for knowledge standardization								0.602	

*Item deleted during construct-level factor analysis.

In the factor analysis two steps have been taken: (1) Making decision on the number of factors to be extracted; In this regard, 4 factors for ERP and 8 factors for KM with Eigen values greater than 1 were obtained and postulated and after that rotated. And, (2) Conducting factor rotation – first level analysis. The rotation sought to render the factor tables much easier to understand and this involved the use of the total variance explained and the principal axis factoring extraction method. Varimax protection with Kaiser Normalisation was utilised to carry out the factor rotation. All the postulated factors at the first level factor analysis stage before rotation explained 72.81% and 83.712 of the variance or spread in the factor space for ERP and KM respectively. These were rotated and a table in the form of a structure matrix was drawn up to make sure that the extracted factors made sense when grouped together and also to enable attaching an appropriate label to each cluster of factors as shown in the Tables 5 and 6.

Table5.Initial Eigen values: total variance explained (ERP)

Factor	Initial Eigen values			Extracted sums of squared loadings			Rotation sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	8.64	48	48	8.64	48	48	4.012	22.291	22.291
2	1.823	10.125	58.125	1.823	10.125	58.125	3.956	21.976	44.268
3	1.557	8.652	66.777	1.557	8.652	66.777	3.07	17.057	61.325
4	1.086	6.033	72.81	1.086	6.033	72.81	2.067	11.485	72.81

Table6.InitialEigen values: total variance explained (KM)

Factor	Initial Eigen values			Extracted sums of squared loadings			Rotation sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	12.514	41.712	41.712	12.514	41.712	41.712	4.045	13.483	13.483
2	2.937	9.789	51.502	2.937	9.789	51.502	3.908	13.026	26.509
3	2.235	7.45	58.952	2.235	7.45	58.952	3.722	12.405	38.914
4	1.965	6.551	65.502	1.965	6.551	65.502	3.158	10.527	49.441
5	1.66	5.534	71.036	1.66	5.534	71.036	2.872	9.573	59.014
6	1.427	4.756	75.792	1.427	4.756	75.792	2.654	8.848	67.862
7	1.203	4.01	79.802	1.203	4.01	79.802	2.628	8.76	76.622
8	1.173	3.91	83.712	1.173	3.91	83.712	2.127	7.09	83.712

In this regard, Fisher's exact test was used instead of a $\chi 2$-test for measuring the independence of two categorical variables (Table 7).

Table7. Fisher's exact test

Pares of factors	Exact Sig. (2-sided)	Exact Sig. (1-sided)
ERP & KM	0.000	0.000

Tests were threshold at a significance level of P< 0.01 using SPSS, since phi correlations are known to create biased estimates of correlation when used with dichotomous data. The phi-correlation coefficient between ERP and KM estimates was 0.781 and was significant (p <0.01) that showed a substantial association and predictive fit. This test Calculation for the pair and phi-correlation coefficients are significant as shown in Table 8.

Table8. Descriptive statistics and correlations among indicator variables

Variables	ERP	KM
ERP	1	
KM	**0.781***	1
***p<0.01**		

4. Findings

The findings supported our proposed hypotheses and model. Empirical analysis led to a significant finding as is shown in Table 9.The result confirmsthe mutually-supporting interaction between KM and ERP systems. It means that ERP systems play an important role in supporting every phase of KM, i.e. knowledge creation, knowledge retention, knowledge transfer, and knowledge application. On the other hand, KM plays an important role in every phase of ERP lifecycle. The results are illustrated in Fig. 2.

Table9. Results of hypothesis testing

Hypothesis	Description	Results
Hypothesis 1	KM affects ERP systems positively.	Supported
Hypothesis 2	ERP systems affect on KM positively.	Supported

6.Deriving the Knowledge-intensive Enterprise System (KES) model

According to the literature and the above findings, it can be concluded that KM naturally tends to improve ES performance, and conversely, ES systems tend to support KM. Therefore, it can be concluded that if KM and ES systems are implemented simultaneously in a company, a mutual KM-ES cooperation will exist. Apart from the cooperation between them, both KM and ES systems seem to be in real need of each other. In order to implement every phase of KM, ES components like portals, intranets, and Virtual Communities of Practice (VCoPs), and data/knowledge repositories should be employed. Likewise, KM should be embedded in every single phase of ES implementation, due to the fact that it is a knowledge-intensive continuous improvement process. Therefore, to propose a model for Knowledge-intensive Enterprise Systems (KES) and their components, factor analysis is again applied to a questionnaire containing 48 items; the 48 items are a blend of KM items and ERP items.

The results of this procedure generated KMO of 0.720 for KES (Table 10), while the corresponding Bartlett's test of sphericity indicated a significant correlation among variables. The high chi-square value associated with a low p-value ($p < 0.01$) indicated significant relationships.

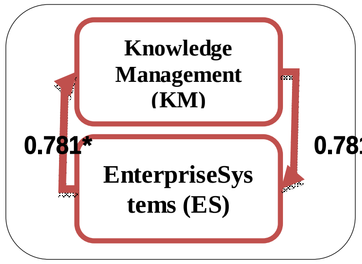

Fig. 2: KM-ES supporting interaction

Table10. Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (MSA) and Bartlett's test of sphericity for the inter-correlation matrix of the empirical dimensions

Factors		KM-ERP cooperation
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.720
Bartlett's Test of Sphericity	Approx. Chi-Square	8026.000
	df	1128
	Sig.	0.000

Afterwards, factor analysis was conducted. Table 11 shows the number of factors extracted for the questionnaire.

Table11. ExploratoryFactor Analysis on KM-ERP cooperation

Measurement Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9	Factor 10	Factor 11	Factor 12	Factor 13	Cronbach'α
ERP13	0.820													0.905
KM8	0.725													
KM20	0.716													
KM7	0.530													
ERP15	0.508													
KM9	0.503													
ERP14	0.480													
KM21	0.430													
ERP7		0.786												0.894
ERP5		0.766												
KM26		0.751												
KM24		0.714												
KM25		0.580												
KM28		0.518												
ERP11			0.836											0.887
ERP17			0.677											
ERP16			0.625											
KM15			0.564											
ERP6			0.519											
KM17			0.467											
KM4				0.852										0.885
KM10				0.667										
KM27				0.624										
KM3				0.615										
KM11				0.568										
KM16				0.542										
ERP12				0.474										
KM12				0.453										
ERP4					0.783									0.886
ERP3					0.704									
ERP8					0.621									
ERP9					0.602									
ERP10					0.527									
KM23					0.520									
KM2						0.833								0.839
KM1						0.726								
KM29						0.700								
KM30							0.785							0.825
ERP2							0.686							
KM18							0.456							
KM6								0.805						0.812
KM13								0.691						
*ERP1									0.883					---
*KM5										0.912				---
KM14											0.683			0.798
KM22											0.617			
*KM19												0.785		---
*ERP18													0.601	---

*Item deleted during construct-level factor analysis.

In the factor analysis, 13 factors for KES with Eigen values greater than 1 were obtained and postulated and after that rotated.

The postulated factors at the first level factor analysis stage before rotation explained 90.798 of the variance or spread in the factor space for KES. This was rotated and a table in the form of a structure matrix was drawn up to make sure that the extracted factors made sense when grouped together and also to enable attaching an appropriate label to each cluster of factors as shown in the Table 12.

Table12. Initial Eigen values: total variance explained (KM-ERP)

Factor	Initial Eigen values			Extracted sums of squared loadings			Rotation sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	20.048	41.766	41.766	20.048	41.766	41.766	5.103	10.631	10.631
2	3.781	7.878	49.644	3.781	7.878	49.644	4.993	10.402	21.032
3	3.174	6.612	56.256	3.174	6.612	56.256	4.771	9.939	30.972
4	2.693	5.611	61.867	2.693	5.611	61.867	4.68	9.75	40.722
5	2.264	4.717	66.584	2.264	4.717	66.584	4.098	8.538	49.26
6	1.905	3.969	70.553	1.905	3.969	70.553	3.69	7.688	56.947
7	1.86	3.876	74.429	1.86	3.876	74.429	3.468	7.225	64.173
8	1.714	3.571	77.999	1.714	3.571	77.999	3.144	6.551	70.724
9	1.519	3.165	81.164	1.519	3.165	81.164	2.222	4.628	75.352
10	1.394	2.905	84.069	1.394	2.905	84.069	2.162	4.503	79.855
11	1.108	2.308	86.377	1.108	2.308	86.377	2.092	4.358	84.213
12	1.091	2.272	88.65	1.091	2.272	88.65	1.76	3.667	87.88
13	1.031	2.148	90.798	1.031	2.148	90.798	1.4	2.918	90.798

After deleting 4 items during factor analysis, 9 factors remained as the main components of KES. Due to the similarity of the last two factors, they can be merged as a unified factor namely "goal alignment". Therefore, 8 factors can be considered as the constituents of KES (Fig. 3). Table 13 depicts the sub-factors of KES.

Table13. Knowledge-intensive Enterprise Systems (KES) factors and sub-factors

	Factors	Sub-factors
Knowledge-intensive Enterprise Systems (KES)	Communication	ERP strategy and implementation methodology
		Commitment of the managers and personnel
		Personnel success in conveying extracted knowledge from external sources to their managers
		Hopefulness of the personnel about provision of enough resources to them by top managers
		Communication
		Company success in provision of a knowledge repository
		Data management
		Personnel success in extracting useful knowledge from external sources for their company
	Environmental issues	Software development, testing, and troubleshooting
		National culture
		Domination of company core knowledge in the industry
		Support of the current IT infrastructure of the company
		Upper management realization of the barrier
		Ability of the other industries in posing a threat to the company
	Business process reengineering	Fit between ERP and business/process
		Business process reengineering
		Appropriate business and IT legacy systems
		Company success in provision of user-friendly software for knowledge standardization
		Organizational characteristics
		Appropriateness of the number of levels in the hierarchical structure of the company
	Management and personnel involvement	Truly understanding by personnel and managers
		Possibility of mapping knowledge communities on the existing organizational structure
		Personnel involvement
		Personnel success in utilization of IT
		Company success in provision of a prototype 1
		Senior managers support for knowledge communities
		Project management
		Usage of a quantitative system for financial evaluation and monitoring in the company
	Monitoring and evaluation of performance	Project champion
		Top management support
		Teamwork and composition
		Business plan/vision/goals/justification
		Monitoring and evaluation of performance
		Awareness of the knowledge that is critical to the company
	Knowledge sharing	Company KM ability in fulfilling the needs of an extended knowledge community
		Realization of positive influence of the obtained knowledge on the company performance
		Success of company KM in provision of channels for knowledge sharing
	IT infrastructure	Company success in provision of user-friendly hardware for knowledge standardization
		Country-related functional requirements
		Support of the company KM system in establishing KM strategies
	Goal alignment	Alignment of the KM goals with personal goals of the personnel
		Commitment of the company in provision of abundant resources to support KM
		Personnel support for knowledge communities
		Alignment of KM goals with the company goals

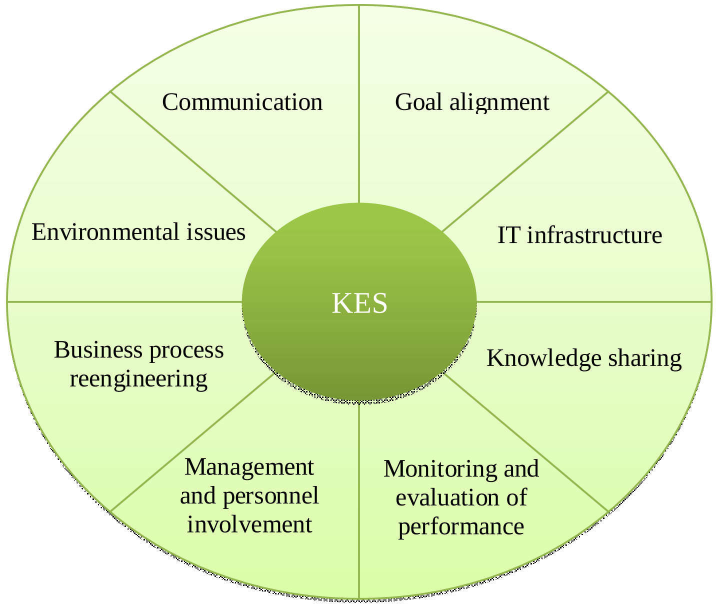

Fig.3. Knowledge-intensive Enterprise Systems (KES) main components

7. Conclusions

The literature lacks a study demonstrating the supportive relationship between Knowledge Management (KM) and Enterprise Systems (ES). Besides, to take advantage of KM and ES capabilities, they should be implemented in an organization simultaneously. On the one hand, KM urgently needs IT infrastructure of ES to have its cyclic phases accomplished; on the other hand, ES implementation, considered as a continuous improvement effort, should embody KM to have the opportunity of prospering. To put it simply, it is not possible to have each one without having the other one; therefore, it sounds logical to integrate KM and ES.

In this study, two steps are taken to fill these gaps. In the first step, the supporting relationship between ERP systems, as the best representative of ES, and KM are demonstrated through utilization of real data of a case study. Then, in the second step, a model is derived from the same data for a novel concept i.e. Knowledge-intensive Enterprise Systems (KES). As stated above, since KM and ES seem inseparable, the concept of KES is trying to present a blend of them to let organizations derive the optimum benefit.

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