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A STATISTICAL MODEL FOR DETERMINATION OF THE TYPE OF KNOWLEDGE MANAGEMENT APPROACH BASED ON ORGANIZATION PROCESSES

Summary

Knowledge management is vital to organization management and is done by pursuing different strategies, which are mainly based on two basic knowledge management approaches called the explicit-oriented approach and the tacit-oriented approach. In this paper, we have tried to consider the type of knowledge strategy of organizations in a new classification including organizations with routine or non-routine processes. Thus, the two important knowledge strategies of organizations, the explicit-oriented and the tacit-oriented strategy, are evaluated using a questionnaire completed by 64 companies of either the type with routine or the type with non-routine processes. Then, the relation between the state of knowledge in the companies and the types of companies was determined by using logistic regression and it was found that the companies which use explicit knowledge operate more routinely and vice versa, the companies which use tacit knowledge operate less routinely.

Key words: *knowledge management strategy, tacit/explicit-oriented organization, routine/non-routine processes, logistic regression.*

1. Introduction

Since the importance of knowledge as one of the most important resources of the organization is increasing, an organization in today's knowledge-oriented world should acquire a suitable strategy for creating value out of its intellectual property. In this area, different strategies are recommended [1]. It is broadly agreed that different organizations can choose from a variety of strategies for knowledge management based on their specific conditions and characteristics [1-3]. Perrow has classified organizations into organizations with routine processes (ORPs) and organizations with non-routine processes (ONPs) based on the number of exceptions encountered in their environment [4]. Lillrank has classified organization processes into three categories, standard, routine, and non-routine, based on their variability and uncertainty. Based on this, with the passage of time and an increase in organization knowledge, non-routine processes change into routine and standard processes [5, 6].

1.1 Knowledge management and its strategies

Company's knowledge management is a framework that considers business processes as the processes which create value added knowledge and empower knowledge management

processes through changing and correcting processes, systems, and organizational culture with the help of knowledge tools and techniques [7]. Hamsen et al. have also defined two main strategies for knowledge management: the codification strategy and the personalization strategy [2]. In the codification strategy, the knowledge of the company is codified and stored in data banks and is accessible to everyone easily, while in the personalization strategy, knowledge is based on the person who has developed the knowledge and transfers it to others. In fact, the codification strategy is based on the people-to-document approach (explicit knowledge) while the personalization strategy is based on the people-to-people approach (tacit knowledge) [8]. Kim et al. have also considered four categories: outside codification, inside codification, outside personalization, and inside personalization, and their efficiency is totally dependent on contextual conditions of the company, such as the maturity of its information systems [9]. Shannak et al. have categorized knowledge-related approaches into three groups: the technology-oriented, the people-oriented, and the asset-oriented knowledge which is based on explicit knowledge, tacit knowledge, and knowledge economic value, respectively [7]. As the above mentioned studies show, the explicit-oriented and the tacit-oriented approaches are presented as two main knowledge management approaches. Thus, we have considered these approaches in this paper.

Researchers believe that the organization will consider one of the knowledge management strategies as its main strategy and use other strategies as supporting strategies [2, 10]. There have been a large number of research efforts considering the choice of a suitable knowledge management strategy for companies and they show that choosing one main knowledge management strategy depends on different characteristics of a company. Linder et al. have studied the choice of a suitable knowledge management approach for temporary organizations which are usually project-oriented [11]. Hamsen et al. have stated that most of the mass production companies have the codification strategy and the companies with customized products and services are the companies that use personalized strategy [2]. Furthermore, Greiner et al. have suggested that the companies which need some improvement in their process efficiency should use the codification strategy and the companies aiming at extending their processes innovation should at first use the personalization strategy [12]. As the aforementioned studies show the most important approaches in the knowledge management area are the explicit-oriented and the tacit-oriented approach [10], and these two approaches will be discussed in this paper.

1.2 Organizations with Non-routine Processes

Perrow has classified organizations and their technologies based on exceptions and unexpected events happening in their environment and the extent to which these exceptions can be analyzed and a specific solution can be found. Perrow has called the companies with few exceptions ORPs. Mostly, companies with mass products or services that have identical and standard activities are of this type. In contrast, in ONPs, there are many exceptions that cannot be analyzed since pre-defined plans do not exist [4]. Moreover, Lillrank believes that organization processes are influenced by environmental changes and new needs. He categorizes organization processes based on their variability and uncertainty into three categories: standard, routine and non-routine processes. Lillrank believes that standard and routine processes are implemented permanently and repeatedly, and their input, process, and output are completely defined. On the other hand, he believes that non-routine processes are the processes that face an unknown input (a new need) and steps, and their output is completely vague [5]. Most of the organizations in the area of consultancy, healthcare, and project-oriented organizations have more non-routine processes compared to routine and standard processes [5, 6].

In this paper, we aim to find which of the two most important strategies of knowledge management, the tacit-oriented or the explicit-oriented strategy, is more suitable for ONPs. In other words, ONPs choose a strategy for their knowledge management. The rest of this paper is organized as follows. In the next section, the research methodology is described. In section 3, we present the results of an empirical study based on the proposed methodology. Finally, the concluding remarks are given in section 4.

2. Research methodology

In this section we propose a new methodology to find the relation between knowledge management strategy and type of organization (ORP and ONP) using logistic regression. In the first subsection, the sampling method is presented.

2.1 Sampling method

The data of this experimental study was received through sampling in companies which are members of the Iranian Quality Management Association (IQMA) and participated in the Iranian National Quality Award (INQA). The companies have been chosen based on two criteria: 1- implementation of quality management system and/or 2- familiarity with the related concepts such as process management. In this study, the approach of key informants was used. Since business process excellence managers have an important role in defining and managing organization processes, they were asked to fill out the questionnaires. 120 excellence or quality assurance managers from the companies were invited to a technical meeting (seminar), which 90 of them attended.

After a detailed explanation of the questionnaire, 80 completed questionnaires were received and finally 64 of them were verified to be used in this study. Table 1 shows some simple statistics about the seminar participants who filled out their questionnaires completely and correctly.

Table 1 Seminar participant data

Product or Service Type		Organization Type	
Mass	34	Product	34
Customized	28	Service	28
Mass and Customized	2	Product or Service	2
Number of Personnel		Working Experience (years)	
< 24	6	< 5	10
25-49	8	6-10	5
50-99	6	11-15	13
100-199	4	16-20	9
> 200	40	> 21	27

2.2 Processes uncertainty

Based on the definition of processes by Iillrank [5], a score sheet including three sections of Input (*I*), Process (*P*), and Output (*O*) was designed with respect to the characteristics of each section. For instance, in the Input section, one of the characteristics is "The process inputs are completely clear and pre-defined". The representative of each company gives a score to each section between zero and 100. Finally, the value of process certainty (*C)* is calculated by multiplying the scores of *I*, *P* and *O*. Obviously, the smaller values of *C* illustrate more uncertainty in the company processes. We need to mention that before using the score sheet in the seminar, the value of certainty for ten companies (from

both manufacturing and service industries) was calculated based on the primary version of the score sheet. Then, the final version of the score sheet was designed according to the feedback received from the managers of those companies and three experts in the area of process management. The score sheet is given in Appendix 1.

2.3 The method of classifying organizations

At this stage, to divide the organizations into ORPs and ONPs, a meeting with 20 quality assurance managers of the participating companies (being in the manufacturing or service industry) was held. Based on the existing conditions of the organizations, organizational environment, types of their processes and the extent to which they face environmental changes, it was decided whether they are ORPs or ONPs. It is noteworthy that in this stage, we chose these companies based on their activities so that both ORPs and ONPs were included. For instance, it was predicted that the companies using mass production are more probable to be ORPs and the companies that provide customized services or organization in the healthcare area are more likely to be ONPs.

After that, a binary variable, namely y was defined, where zero and one indicate an ORP and an ONP respectively. Since the variable y depends on the variable C, the relation between these two variables was defined based on the logistic regression model. Then, the value and the probability of y for the remaining 44 companies were obtained based on the value of their C. Hence the companies with a high probability for y=0 were defined as ONPs.

2.4 Analysis of organization's knowledge approaches

Standard and routine processes are replicable and pre-defined and are mostly implemented based on formal rules and documented procedures. Therefore, the management of such processes is system-oriented and their knowledge management approach is more likely to be explicit-oriented [13-16]. This is because non-routine processes are less predictable and documentable and their implementation is more based on the expertise and experience of people [17]. The knowledge management approach of this type of processes is more probably tacit-oriented [13, 14]. Generally speaking, the more we move from non-routine processes towards standard processes, the explicit knowledge level of the company increases [13, 18]. As a result, in this study, the knowledge management approach (tacit-oriented and explicit-oriented) is one of the differentiable specifications of ORPs and ONPs.

For determining the type and knowledge level of companies based on Yuvan, Nicolan et al., and Birasnav, a set of questions were defined [19-21]. For content validation, the questions were reviewed by six experts in meetings and the number of questions reduced to 13 divided in three sections, including knowledge acquisition (KA), knowledge application (KAP), and knowledge transfer (KT) (see Appendix 2). For each question, a five-point Likert scale ranging from 1 (totally disagree) to 5 (totally agree) was considered so that the higher number of points shows that the company's approach is more explicit-oriented. After receiving the completed questionnaires from 64 companies, Cronbach's Alpha was used to determine the reliability of the questionnaire for each of the three sections using the SPSS 21 software. The values of the indices are presented in Table 2.

Table 2 Values of Cronbach's alpha for knowledge management questionnaire

Section	Knowledge acquisition	Knowledge application	Knowledge transfer	Total
Cronbach's alpha	**0.810**	**0.794**	**0.762**	**0.829**

As Table 2 shows, the questionnaire has suitable reliability, because the value of Cronbach's alpha for each section is more than 0.7. Furthermore, the total Cronbach's alpha

for the questionnaire is equal to 0.829. This number indicates suitable reliability considering all questions together [20]. In addition, for measuring the validity, an exploratory factor analysis (EFA) was conducted by using the LISREL 8.8 software and the results are represented in Table 3. The results show that the analysis is appropriate since the value of the Kaiser-Meyer-Olkin (KMO) measure based on the principal component analysis (PCA) is greater than 0.6 (0.77) and Bartlett's sphericity test is statistically significant at a level of less than 0.05 (0.00). In addition, the equamax rotation shows that almost all items have loading factors greater than 0.6. Moreover, the main indices of the EFA, consisting of P-value=0.0183, RMSEA=0.085, GFI=0.84, CFI=0.92, IFI=0.92, NFI=0.82 and NNFI=0.89 show the appropriateness of using this EFA [21].

Table 3 Exploratory factor analysis for knowledge management

Indicators	Latent factors		
	KA	**KAP**	**KT**
x1	0.700		
x2	0.762		
x3	0.555		
x4	0.718		
x5	0.822		
x6		0.694	
x7		0.763	
x8		0.669	
x9		0.622	
x10		0.814	
x11			0.787
x12			0.814
x13			0.840
Eigenvalue	4.418	2.021	1.764
Explained variance	33.986	15.547	13.567
Accumulated	33.986	49.533	63.101

Notes: Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO=0.726); Bartlett's sphericity test: $\chi^2 = 74.283$, $df = 51$, $p = 0.002$; Extraction Method: Principal Component Analysis (PCA); Rotation Method: Equamax Rotation; Rotation has converged after five iterations.

2.5 Model development

In this step of examining the knowledge management approach of ONPs, a regression model between y and the latent factors (KA, KAP and KT) coming from the exploratory factor analysis is determined. Thus, a link function will be created based on the factor scores and y. For more information about factor scores refer to Sharma [22]. Note that the link function between the factor scores and y is defined as binary logistic regression.

3. The results of the empirical study

In this section, based on our proposed methodology, a statistical analysis is conducted to determine the relation between the knowledge management factors (KA, KAP and KT) and the organization type (routine and non-routine processes). In the next subsection, the relation between C and probability of *y* for 20 companies (that their types, y, were known in advance) is determined.

3.1 Classifying organizations

In this subsection, the logistic regression model was applied to find the relation between C and probability of *y* for 20 known companies as given in Equation 1. As mentioned before, *y* is a binary variable, where zero indicates an ONP and one represents an ORP.

$$\pi_i = \frac{e^{-1.253+0.066c_i}}{1+e^{-1.253+0.066c_i}} \tag{1}$$

In Equation 1, C_i is the value of certainty of the processes in the i^{th} organization and π_i is the probability of each treatment (or the probability of being an ORP). Moreover, values of the measures of association for the logistic regression model are given in Table 4.

Table 4 Association measurements of logistic regression model

Index	
Goodman-Kruskal Gamma	Somers'D
0.73	**0.73**

Since the values of the measures of association are greater than 0.5, the proposed model has an appropriate fitness value for predicting the type of ORPs and ONPs. As Equation 1 shows, the coefficient of C_i is positive, meaning that, as C_i increases, the probability of being an ORP increases as well. After deriving the logistic regression model, the probability of the response variable (*y*) for the remained 44 companies was predicted by Equation 1, so that for the organizations with a probability greater than 0.5, "*y* =1" (i.e., these organizations are considered to be ORPs), and for organizations with a probability less than 0.5, "*y* =0" (i.e., these are considered to be ONPs). Therefore, the probability of the response variable was calculated for all 64 companies based on the values of process certainty of these organizations. Now, by knowing the value of the response variable (organization type) for all companies, we can find the relation between the response variable and the knowledge factor scores which will be discussed in the next subsection.

3.2 Logistic regression model analysis and predicting probability of being an ORP

As mentioned in the previous sections, a binary logistic regression model was used for determining a relation between the factor scores and the response variable. In this subsection, we firstly calculate the value of factor scores for the 64 organizations by using the Minitab 17.1 software and the results along with the type of the ORP and ONP are given in Table 5.

Table 5 Factor scores and type of organization

Company	Indicator: Knowledge Management			Type	Company	Indicator: Knowledge Management			Type
	Latent Factors					Latent Factors			
	KA	KAP	KT			KA	KAP	KT	
1	-2.036	-1.274	-0.484	0	33	0.885	-0.103	0.289	1
2	-1.096	0.673	0.690	0	34	0.005	-0.140	0.365	1
3	1.333	0.165	-1.594	1	35	0.593	1.415	0.224	1
4	0.402	0.484	0.318	1	36	-1.289	-0.947	-1.245	0
5	-2.077	2.189	-0.986	0	37	0.392	-1.798	1.212	0
6	-0.532	1.402	-0.756	0	38	-0.389	-0.377	0.902	0
7	0.743	1.432	0.298	1	39	-2.772	-0.805	1.225	0
8	-1.470	-0.466	1.504	0	40	-1.244	0.089	1.161	1
9	1.233	-0.613	-0.513	1	41	0.108	0.466	0.320	0
10	0.453	0.325	-0.311	1	42	0.796	-1.052	0.270	1
11	-0.132	-0.635	1.156	0	43	1.320	-1.348	1.854	1
12	-0.313	0.513	-0.463	0	44	-0.570	0.040	0.464	1
13	1.407	0.754	0.196	1	45	-0.517	-2.219	-1.717	0
14	0.387	-0.731	1.813	1	46	-0.594	1.080	0.324	0
15	-0.890	0.642	-0.402	1	47	-0.427	0.312	0.415	0
16	-0.479	1.716	-1.354	1	48	1.568	-0.163	-0.294	1
17	1.201	0.569	-0.728	1	49	0.500	0.010	0.799	1
18	-1.116	-0.038	0.447	1	50	-0.130	1.265	1.625	1
19	1.195	0.902	1.065	0	51	0.509	0.345	0.837	1
20	-0.226	1.368	1.134	0	52	-1.064	-0.136	0.673	0
21	-0.445	-0.586	-0.352	0	53	-0.082	-0.941	0.748	0
22	1.730	0.706	0.215	1	54	0.498	0.091	-1.375	1
23	-0.851	0.210	-1.708	0	55	0.436	1.108	0.765	1
24	-1.616	0.230	0.032	0	56	-0.136	-0.859	0.089	0
25	0.776	-1.713	0.729	1	57	0.385	-1.092	0.113	0
26	0.555	0.420	1.212	1	58	1.330	-0.715	0.862	1
27	1.237	-1.926	-0.542	1	59	-0.042	-1.117	0.920	1
28	-1.286	1.655	-2.736	0	60	0.793	-0.179	1.261	1
29	0.224	1.101	0.378	1	61	1.475	0.532	-0.283	1
30	0.641	1.179	0.299	1	62	-0.414	-0.904	0.544	0
31	0.016	0.370	-1.584	1	63	-0.125	-0.684	-0.207	0
32	-1.509	-2.065	-0.790	0	64	0.742	-0.137	-1.990	1

As Table 5 illustrates, out of the 64 organizations, 36 are ORPs and the rest of them are ONPs. Now, by using the scores of the knowledge management factors and the type of organization, a link function based on the binary logistic regression model can be determined.

In order to derive the binary logistic regression model, the coefficients of three latent factors, i.e. KA, KAP, and KT, were estimated as given below.

$$\hat{\boldsymbol{\beta}} = \begin{bmatrix} 0.323 & 2.102 & 0.582 & -0.141 \end{bmatrix}$$

Note that 0.323 is the constant parameter of the model and 2.102, 0.582 and -0.141 are the coefficients of KA, KAP and KT, respectively. On this basis, the binary logistic regression model was defined and for each organization the probability of being an ORP was calculated by using the Minitab 17.1 software. The probability of being an ORP for each organization is determined by Equation 2.

$$\pi_i = \frac{e^{0.323+2.102KA+0.582KAP-0.141KT}}{1+e^{0.323+2.102KA+0.582KAP-0.141KT}} \tag{2}$$

Values of the measures of association for the logistic regression model are given in Table 6.

Table 6 Measures of association for logistic regression model

Measurements	
Goodman-Kruskal Gamma	Somers'D
0.77	**0.77**

As Table 6 shows, the measures of association are greater than 0.5, meaning that the logistic regression model is appropriate. Therefore, the fitted model can be used for all the organizations to determine the probability of their routines to be based on their knowledge condition. The probability of being an ORP for each of the organizations, which is calculated based on 13 questions of the questionnaire, is given in Table 7. It is noteworthy that the variable *y* in Table 7 is a non-metric response variable taking the values zero and one, where one indicates ORPs and zero represents ONPs.

Table 7 Probability of being ORP for 64 organizations

Organization	x1	x2	x3	x4	x5	x6	x7	x8	x9	x10	x11	x12	x13	*y*	Probability of being ORP
1	1	1	1	3	1	1	4	1	1	3	4	3	2	0	0.00965
2	2	1	2	3	4	2	4	3	3	5	4	4	3	0	0.15627
3	4	2	3	4	4	3	2	4	5	3	2	3	4	1	0.96912
4	3	2	4	3	2	2	3	3	4	4	4	4	3	1	0.80318
5	1	1	2	1	1	2	5	3	4	5	3	2	4	0	0.06739
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
60	4	4	3	4	3	3	3	3	4	3	5	5	4	1	0.84650
61	5	2	4	5	5	4	4	3	5	4	3	4	4	1	0.97756
62	2	4	1	3	2	2	2	3	3	4	5	3	4	0	0.24031
63	3	2	1	4	2	2	3	3	4	3	2	5	3	0	0.42342
64	4	3	3	3	4	4	4	3	2	2	2	2	3	1	0.88933

As it can be seen in Table 7, the probability of being an ORP for each organization based on the values of the 13 knowledge management variables is determined. Note that the scores of the latent factors are estimated based on the values of the 13 variables of knowledge management, and then Equation 2 is used to calculate the probability of being an ORP for each organization. Table 7 clearly reveals that the probability of being ORPs for ONPs such as 1, 2, 5, etc. is low and this probability for ORPs like 3, 4, etc. is high. This indicates that the classification of the organizations is done correctly. But we must consider that the derived logistic regression model allows the prediction whether any other organizations are ORPs or ONPs based on their knowledge condition. For this purpose, different scenarios are simulated by using the MATLAB software as reported in Table 8. In fact, by assigning random values to 13 variables (13 questions of the questionnaire) a number of simulated scenarios were generated. Then, the probability of being an ORP for each scenario was calculated by using the logistic regression model obtained earlier in this subsection.

Table 8 Different scenarios to predict organization type

Scenario	x1	x2	x3	x4	x5	x6	x7	x8	x9	x10	x11	x12	x13	Probability of being ORP
1	4	1	2	2	1	1	3	2	2	4	4	2	1	0.8205
2	2	3	1	4	3	1	1	1	1	3	5	4	3	0.6431
3	1	4	3	2	3	3	2	4	3	4	4	4	3	0.9164
4	2	1	1	1	4	3	4	2	1	3	2	5	5	0.6348
5	2	2	1	2	1	3	2	2	3	1	3	4	2	0.1791
6	2	1	3	4	4	1	1	3	2	5	5	5	2	0.9172
7	1	2	2	1	3	2	1	3	2	2	3	3	3	0.4046
8	1	2	2	2	2	3	1	1	3	3	4	2	5	0.5771
9	1	1	1	2	1	5	2	5	1	2	2	2	4	0.0569
10	2	1	1	1	2	5	4	5	1	1	5	3	4	0.2873

It can be seen that the ten scenarios are classified into two different types. Note that since the probability of being ORPs for the scenarios 5, 7, 9, and 10 is less than 0.5, these organizations are ONPs. Because the probability of being ORPs for the remained scenarios is greater than 0.5 these organizations are ORPs. But in this paper it is claimed that by an increase in the values of the 13 variables of knowledge management, the organization moves toward being an ORP. In other words, when the values of knowledge management variables of an organization increase, the probability of being an ORP for that organization grows up. Thus, we performed a sensitivity analysis to evaluate the impact of these variables on the probability of being an ORP. For this reason, the effect of the variables on the probability of being routine was calculated, and a part of this analysis is presented in Table 9. It is noteworthy that the first scenario in Table 8 is used as the reference scenario for the sensitivity analysis.

Table 9 Evaluating sensitivity of being an ORP to variables

Scenario	x1	x2	x3	x4	x5	x6	x7	x8	x9	x10	x11	x12	x13	Probability of being ORP
Reference	4	1	2	2	1	1	3	2	2	4	4	2	1	0.8205
1	2	1	2	2	1	1	3	2	2	4	4	2	1	0.5964
2	5	1	2	2	1	1	3	2	2	4	4	2	1	0.8469
3	4	3	2	2	1	1	3	2	2	4	4	2	1	0.9493
4	4	1	1	2	1	1	3	2	2	4	4	2	1	0.5985
5	1	4	4	2	1	1	3	2	2	4	4	2	1	0.9779
6	4	1	2	1	1	1	3	2	2	4	4	2	1	0.7757
7	4	1	2	4	1	1	3	2	2	4	4	2	1	0.8732
8	4	1	2	2	3	1	3	2	2	4	4	2	1	0.9203
9	4	1	2	2	1	2	3	2	2	4	4	2	1	0.9015
10	4	1	2	2	1	1	1	2	2	4	4	2	1	0.7277
11	4	1	2	2	1	1	5	2	2	4	4	2	1	0.8693
12	4	1	2	2	1	1	3	1	2	4	4	2	1	0.8218
13	4	1	2	2	1	1	3	4	2	4	4	2	1	0.8726
14	4	1	2	2	1	1	3	2	1	4	4	2	1	0.8017
15	4	1	2	2	1	1	3	2	3	4	4	2	1	0.8439
16	4	1	2	2	1	1	3	2	2	2	4	2	1	0.4810
17	4	1	2	2	1	1	3	2	2	5	4	2	1	0.8977
18	4	1	2	2	1	1	3	2	2	4	1	2	1	0.5896
19	4	1	2	2	1	1	3	2	2	4	5	2	1	0.8638
20	4	1	2	2	1	1	3	2	2	4	4	1	1	0.8168
21	4	1	2	2	1	1	3	2	2	4	4	3	1	0.8492
22	4	1	2	2	1	1	3	2	2	4	4	2	2	0.8475

Table 9 shows that if the value of each of the 13 variables of knowledge management increases, the probability of being an ORP also increases. As an example, by changing the value of variable x1 from 4 to 2, the probability decreases from 0.8205 to 0.5964 and if x1 increases from 4 to 5, the probability increases from 0.8205 to 0.8469.

4. Conclusion

This study proposes a model which helps managers to make the right decision about their knowledge management strategy in such a way that the value of the 13 variables for their organization is identified, the type of organization (ORP or ONP) is determined and then based on the organization type, the KM strategy (tacit-oriented or explicit-oriented) is determined. The results confirm that as the 13 variables of knowledge management become closer to 5, the probability of being an ORP increases and also as the variables get closer to 1,

then the probability of being an ORP decreases, i.e., the probability of being an ONP grows. Note that the questionnaire was designed in such a way that high values of these variables mean that the organizational knowledge is more of the explicit-oriented type while low values of the variables indicate that the organizational knowledge is more of the tacit-oriented type. Hence, our claim that the probability of being an ORP increases as the values of each of the 13 variables of knowledge management increase, is substantiated. We can conclude that the results of this study confirm that as the level of the explicit-oriented knowledge in an organization increases, the organization moves toward being an ORP and also as the level of the tacit-oriented knowledge in an organization increases, the organization moves toward being an ONP.

But as it was mentioned earlier, the researchers believe that the organizations can choose one of the knowledge management strategies as the main one and use the others as complementary to or for supporting the main strategy. Hence, it is clear that ONPs, which, based on the results of this study, mainly use the tacit-oriented strategy, can also consider the explicit-oriented approach as a supporting strategy to their main strategy.

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Appendix 1

Inputs	0%					25%					50%					75%					100%			
Process inputs - Are completely predefined and clear. - Are identical and replicable. - Have limited and specific acceptance criteria. - There is only one need as the input - The required resources for implementing a process are accessible.	No evidence or anecdotal					Some evidence					Evidence					Clear evidence					Comprehensive evidence			
I			1	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	
Process	0%					25%					50%					75%					100%			
Process stages - Are predefined and clear. - Process input assessment follows binary logic (accept or reject). - Are documentable and worth documenting (documentation). - Are based on documented instructions and rely less on people's experience and knowledge. - For each replicate, the process is repeated and the sequence of activities is fixed. - Have low uncertainty.	No evidence or anecdotal					Some evidence					Evidence					Clear evidence					Comprehensive evidence			
P			1	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	
Outputs	0%					25%					50%					75%					100%			
Process outputs - Are fixed and limited to only one output - Are predefined and clear. - Have limited and specific acceptance criteria. - The volume of output data can be analyzed by statistical techniques. - The focus is on output variation rather than output variety.	No evidence or anecdotal					Some evidence					Evidence					Clear evidence					Comprehensive evidence			
O			1	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	
C^{1}=I*P*O																								

[1] Certainty

Appendix 2

No.	Question	Phase	Ref.
1	The organization actively collects, records and analyzes the required information about the needs and expectations of customers and occasionally interacts with them orally.	**Knowledge Acquisition**	[21]
2	The organization collects new knowledge for solving problems or creating new opportunities through research (e.g. by collaboration with universities).		[21]
3	The organization collects, records, and analyzes the information of its competitors as an inspiring source for developing new methods.		[21]
4	Employees regularly attend courses, training programs, and professional seminars for improving their knowledge.		[19]
5	The organization possesses comprehensive and suitable programs, training courses and archives.		[20]
6	Knowledge (including how to do work, technical skills, or methods of problem solving) is codified suitably in the organization.	**Knowledge Applicant**	[19]
7	The organization is well able to produce and support products and services, based on the available knowledge, for applicants and rarely new innovation and knowledge is required.		[21]
8	The organization provides new products or services by using and merging other areas of knowledge and combining different ideas and viewpoints.		[20]
9	Regular meetings are held in the organization and the results of the meetings are used to improve the business.		[21]
10	To which extent can the problems of the organization be solved based on previous experiences?		[19]
11	New employees need to collect the required information for doing the job mostly from their colleagues or a mentor.	**Knowledge Transfer**	[20]-[21]
12	The required knowledge is distributed through documents (forms, procedures, work instructions, regulations, etc.) and manuals of the company.		[19]
13	Databases and knowledge banks of the company have a suitable situation and staff have an active role in completing and using the banks.		[20]