Exploring the Knowledge Management Index as a Performance Diagnostic Tool

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ABSTRACT

The knowledge management index (KMI) has been proposed as a parsimonious and useful tool to help organizations gauge their knowledge management (KM) capabilities. This may be the first step in understanding the difference between what an organization is currently doing and what it needs to do in order to maintain and improve its performance level. At the macro level, the index enables organizations to compare themselves with each other. At the micro level, it calls attention to areas needing improvement in current and future KM initiatives. In either case, the KMI provides a robust indicator and basis for business decision-making and organizational support and development.

This paper presents a holistic approach to KM that relates key knowledge management processes (KMP) and critical success factors (CSF) needed to successfully implement it. By juxtaposing these processes and success factors, we create Belardo's matrix that will enable us to characterize an organization and estimate the KMI.

At the macro level, we used realized KMI values and OP estimates to confirm the positive correlation between the KMI and OP. Additional findings include comparing the current and expected role of KM in organizations and discussion for marginal values of rows (CSF) and columns (KM Processes) of the proposed matrix.

***Keywords*:** knowledge management index, critical success factors, knowledge management processes, organizational performance, business-decision support and strategy

1. INTRODUCTION

Most organizations today recognize that knowledge is the currency of the 21st century. This recognition has motivated organizations to pursue a range of activities that fall under the canopy of knowledge management. Unfortunately because the field of knowledge management is still in its infancy and still evolving, there are as yet no time-tested or standard methodologies that organizations can employ to successful manage knowledge [1]. Although there is general agreement that managing knowledge is beneficial, firms have had a hard time deciding what must be done in order to reap the maximum benefits of knowledge management.

In their attempts to manage knowledge, firms have employed various approaches to knowledge management including those that focus on styles [2], orientations [1], opportunity portfolios [3]; activities [4], strategy ([5]; [6]; [1]), projects [7], value chains [8]; [4]; [9], and methods [10].
Note: This paper is an updated and expanded version of our conference papers listed as [24], [22], [21], and [13].

2. THEORETICAL BACKGROUND

Our research is based on a review of the literature that can be classified according to the following four categories: conceptual understanding of knowledge and knowledge management, knowledge-based organizations and knowledge assets, knowledge management processes implementation and critical success factors, knowledge management strategies, organizational competitiveness

2.1. Conceptual Understanding of Knowledge and KM

Although a conceptual understanding of knowledge can be approached from various perspectives, such as philosophical, religious, cognitive, practical, etc., the KM literature has focused on the practical perspective, discussing it, for example, in the data-information-knowledge continuum (e.g. in [11], [12], [13].) These authors discuss data as a set of discrete facts about an event, information as data in a context, and knowledge as information combined with experience, context, interpretation, and reflection. Two types of knowledge emerge: tacit (in peoples' minds) and explicit (in documents). In [14] the authors conclude that one's knowledge must be communicated to be available for use elsewhere; information hoards bring no value. They also contend that KM is a systematic and organizationally specified process for acquiring, organizing and communicating both tacit and explicit knowledge of employees so that other employees may make use of it to be more effective and productive in their work.

2.2. Knowledge-Based Organizations and Knowledge Asset Value

A number of organizational forms in the KM literature have been discussed. The central one is the knowledge-based organization. These organizations are valued on the basis of their knowledge, which is viewed as an asset. Knowledge as an asset consists of five main forms: human, intellectual, social, organizational and structural. It exists as the organization's knowledge regarding itself, its business processes, technologies, products, markets, and environment (e.g. in [14].) KM projects focus explicitly on knowledge as opposed to information and data with objectives to create knowledge repositories, improve knowledge access, enhance the knowledge environment, and manage knowledge as an asset (e.g. in [11].).

In terms of organizational capabilities, (e.g. in [15]) important factors such as culture, technology and organizational structure are key elements in establishing the capabilities of an organization. Two other organizational models discussed in the literature are the extended enterprise model, composed of the enterprise, customers, distributors and suppliers (e.g. in [12].) Given the uncertainty of the business environment in which competitive advantage must be maintained, it is not uncommon to find organizations simultaneously being classified according to one or more of these models.

2.3. KM Processes, Implementation and Critical Success Factors

Knowledge is both a product of, and input to, processes. Major processes include generation/identification, elicitation, dissemination and utilization (e.g. in [12], [13].) A phase-wise matrix implementation of the above processes against specific critical success factors has been suggested in [13].

KM projects have been judged by success indicators similar to those used for assessing other business initiatives. Such indicators include visible growth in resources attached to the project, growth in the volume of knowledge content and usage, likelihood of survival, etc. [11]. Evidently, the success of KM in organizations depends on several factors. Based on an exploratory study, (in [11]), eight such factors were hypothesized: link to economic performance or industry value, technical and organizational infrastructure, standard, flexible knowledge structure, knowledge-friendly culture, clear purpose and language, change in motivational practices, multiple channels for knowledge transfer and senior management support. These factors have been encapsulated into four general critical success factors (CSF) – technology, leadership, culture and measure [13].

In discussing these factors, authors all agree that KM is an expensive undertaking that organizations must closely monitor so as to be able to assess its usefulness. Because of the abundance of advanced ICT tools, technology related factors present the least obstacle to success. Culture related factors on the other hand present the greatest obstacle. This is due in part to the differences in how individuals and organizations value knowledge. Duffy (in [12]) stresses that success is all about maintaining a balance between technology and people in a working environment. This he states is the key driver.

2.4. KM Strategies

KM as a conscious practice is so young that executives lack successful models and strategies that they could use as guides (e.g. in [16], [1].) Codification (coding and storing knowledge in databases, used for example by Accenture) and personalization (helping people communicate knowledge, not store it, used for example by McKensey) are two such strategies. They generally reflect the competitive advantage of the organization. Both strategies are geared towards creating customer value, determining not only how that value supports an economic model but also how the company's people deliver on the value and the economics (in [16].) Three key questions to answer when considering these strategies: Does the organization offer standardized or customized product? Is the product mature or innovative? Do people rely on explicit or tacit knowledge to solve problems?

Earl (in [1]) indicates that the strategy adopted for KM in an organization depends on the school of thought: systems, cartographic, engineering, commercial, organizational, spatial, and strategic. Each of these schools can be distinguished by attributes including: focus, aim, unit, CSF, principal IT contribution and philosophy. Earl suggests that knowledge should be considered as a determinant of, or variable in, organizations' business strategy.

2.5. Organizational Competitiveness

Six models of business competitiveness have been widely discussed in the literature. The first is the industrial and organization (I/O) model of the firm discussed in fifties. The I/O model argues that a firm's performance and hence competitiveness depends on the characteristics of the environment in which it operates. The second is based on extensions of the I/O model. In the extensions, Porter discusses business competitiveness in terms of a "Five Forces" industry model. The model depicts industry competitors, suppliers, buyers, substitutes, and potential industry entrants characterized by rivalry among existing firms. To succeed within the realm of these "Five Forces", a firm seeks to employ one two basic tactics – low cost or differentiation. However, given the existence of an industry structure, the competitive advantage can be extended in scope, and directed towards a narrow or a broad target. The third model, the resourced-based model suggested by Barney, posits competitiveness to be based on firms' resources. The fourth model proposes core competences as distinctive, inimitable characteristics a firm requires to be competitive. The fifth model, the knowledge-base view (in [14]) of the organization opines on the same philosophy as the core competence model, focusing on knowledge. The last model, flexibility, (e.g. in [17]) requires firms to be flexible and adaptive in its business processes in order to be competitive.

2.6. Organizational Performance

Many approaches have been suggested in the literature to measure business performance. Most studies, especially IT related studies, have suggested measurements readily used by top management. Given that a single measure is often not sufficient to capture all contributing factors to an organization's strategic performance, a system of measures must always be employed. For example, Altinkemer (in [18]) argued that more than one productivity or financial measure is needed to accurately judge a firm's performance rather than a single productivity or financial measure.

Comparable to business process reengineering and from an organizational change perspective, the objective of KM is usually long-term overall strategic performance of the organization. Such performance can only be captured by a system of measures [18].

3. PROBLEM STATEMENT

While some may herald the flourishing of knowledge management, we believe the numerous approaches cited above are indicative of the difficulties firms face in their attempt to manage knowledge. In [19] maintains that in a knowledge economy, firms are better off balancing knowledge-based resources and capabilities with the knowledge required to create superior market products and services. In an increasingly turbulent and uncertain economy, the key questions confronting executives are which knowledge resources should be balanced and how?

To begin to address these questions, firms need metrics that can serve as a measure of their knowledge management potentials. Again [19] proposes a knowledge strengths, weaknesses, opportunities, and strengths (K-SWOT) analysis to identify knowing-doing gaps that can form the basis of organizational knowledge-related activities. In line with Zack, [20], propose a knowledge gap analysis, comprising risk analysis, nature of knowledge, and strategic vulnerability analysis. While K-SWOTs and/or knowledge gap analysis many be daunting to some firms, especially those embarking on formal knowledge for the first time, the need to assess the firm's ability to manage its knowledge cannot be exonerated.

Given the above knowledge management approaches, we recognize the relevance of various knowledge management processes such as identification, elicitation, dissemination, and utilization of knowledge as well as critical success factors, such as leadership, culture, technology, and measurement. If management could establish the relative merit and importance of each of these processes and critical success factors, then the firm would be one step closer to balancing its resources in order to close it knowing-doing gaps as suggested by [19].

We extend the above discussion dealing with the macro level of a knowledge management index (KMI) suggested by [21] and [22] to a micro level in an attempt to provide executives with guidelines that we propose can be helpful in balancing their knowing doing gaps.

4. METHODOLOGY

4.1 Modeling and Computing the KMI

Based on the literature discussed, it is clear that knowledge management is multi-faceted. A metric that depicts the health of knowledge management in organizations should take into account as many facets as possible. In the following section, we introduce and model such a metric. We call this metric the knowledge management index (KMI) of organizations, and we show how to construct it.

The following assumption is considered as the basis of our model: in every organization, there is persistent interaction between knowledge management processes under the influence of critical success factors, orchestrated by some actors: employees, customers, partners, and the environment of the organization.

One specific view of knowledge management is the one based on [13]. In this matrix, (Belardo's matrix, see figure below), the columns represent four typical knowledge management **P**rocesses, P_j, j=1,4 and the rows represent four critical **S**uccess factors, S_i, i=1,4.

	Identifi-cation	Elicita-Tion	Dissemi-nation	Utiliza-tion
Technology				
Leadership				
Culture				
Measurement				

A holistic approach to modeling and constructing the KMI of organizations extends the specific approach discussed above by striving to capture the resultant interaction of the processes and the actors (employees, customers, partners and the environment of the organization), rather than viewing them separately. The joint interaction is capture by appropriate constructs relating the processes to the actors and vice versa. For each construct, a number of question items can be devised. The literature suggests that each construct should have at least two questionnaire items. Our initial survey follows this suggestion, but it is not a model limitation. If more constructs are needed, it can be easily accommodated in the KMI calculations. Of interest in the modeling of the KMI is the total number of questionnaire items that can be measured to examine knowledge management as completely as possible. Let's suppose that we have a total of Q measures for all the Z constructs. After administering our questionnaire, we have a series of measures with values r_α, α=1…Q, with a minimum value s_{min} and a maximum value of s_{max}, where s_{min} and s_{max} are the minimum and maximum value of the continuous measurement scale used to obtain the rating of items on the questionnaire. These measures are then used to compute the KMI. The general approach is as follows:

1. We summed the scores for all Q measures. This results in a simple scale running from s_{min} (least level of the interaction for all the items) to $Q*s_{max}$ (if all the items were scored at maximum level).
2. Within each organization the scores for all the items are averaged, to obtain the KMI, as KMI (organization) = $\Sigma r_\alpha/Q$ so that each organization could be rated between s_{min} to $Q*s_{max}$.

4.2 Instrumentation

A survey questionnaire was designed with items to measure the constructs pertaining to the KMI. There are 16 concepts presented reflecting the interaction between the knowledge management processes and critical success factors. Each concept is followed by two questions.
In all, the questionnaire includes 32 items on two levels. On the first level, we introduce a measure reflecting the importance of each of the thirty-two items to the organization. We introduced this measure because from our experience, organizations have different emphasis on different facets of KM. The KMI is originally focuses on "what is." Here, the appropriate measure is realized KM. Also, we think it is necessary to bear in mind "what will or should be." This is measured by perceived value. This gives a time dimension to the research, with possibilities for longitudinal studies

On the second level of extension, we included survey items designed to measure organizational performance (OP) as well as demographics that were absent in the original instrument [22]. After an extensive literature review, we generated sixteen performance-related items and six demographic items

The way to answer a question is to choose one of the possible suggestions: SD-Strongly disagree, D-Disagree, NS-Not Sure, A-Agree, and SA- Strongly Agree.
For example, to identify opinion about ***Technology and Identification,*** there are two questions

1.1 Employees have at their disposal appropriate technology tools to identify critical knowledge for business activities as required
1.2 Organization has a strategic program in place to identify, collect and analyze business intelligence information to develop business strategy

The complete survey instrument (proposed in [22]) for calculating the KMI was expanded and has been used in a small empirical research study [21]. For the KM Process (Knowledge skills), we created variables for Identification (I), Elicitation (E), Dissemination (D) and Utilization (U) by averaging the scores on the questions in the respective columns of the matrix.

Similarly, for the CSFs (Knowledge Management Readiness) dimension, we created similar variables for Technology (T), Leadership (L), Culture (C), and Measurement (M) by averaging the scores on the questions in the respective rows of the matrix. After presenting sample and data collections, those calculations were conducted and aggregated for the private and governmental sector, at two levels: realized and perceived. A separate set of 16 questionnaire items were used to measure organizations' performances for both sectors in non-financial terms.

4.3. Sample and data collection

The unit of analysis for this study was the organization. The survey method was used to collect data for this study. Respondents were drawn from a purposive sample of the European participants of the University at Albany/Zurich Graduate School of Business Administration (UAlbany/Zurich) Executive Master of Business Administration (EMBA) program.

One of the authors administered the survey in person. Participants were briefed of the study, and informed that participation was voluntary and had nothing to do with their normal course work. It was also emphasized that if more than 2 individuals were from the same company, only one of them should respond to the questionnaire. It is important to mention that we used another approach in [13] where there were only six companies and the total of 18 respondents. In that study, answers were aggregated if coming from the same company.
In lieu of financial incentives as suggested by [23], participants were promised a summary of the study. Of the 52 questionnaires administered, 38 useable ones were returned, giving a response rate of 73.10%.

5. DATA ANALYSIS AND RESULTS

5.1 . Descriptive statistics

About 60% of the participants were mostly mid-level managers and directors. The rest of the sample was composed of upper level executives and miscellaneous titles in about the same proportion (Exhibit 1).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Mgr/Dir	22	57.9	57.9	57.9
	CIO/CKO/CFO	6	15.8	15.8	73.7
	VP/P/CEO	2	5.3	5.3	78.9
	Others	8	21.1	21.1	100.0
	Total	38	100.0	100.0	

Exhibit 1: Job titles for all participants

Respondents' tenure with companies is quite impressive (Exhibit 2), with the mean between 3 and 3.5 years of experience with the same company.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<= 2 yrs	9	23.7	24.3	24.3
	2 - 3.9 yrs	19	50.0	51.4	75.7
	4 - 5.9 yr	8	21.1	21.6	97.3
	> 15 yrs	1	2.6	2.7	100.0
	Total	37	97.4	100.0	
Missing	System	1	2.6		
Total		38	100.0		

Exhibit 2: Respondent Tenure (yrs)

Most of these organizations are large in size: 21 of them (55 %) had more than 2,000 employees, while 3 (8%) had less than 50 employees; and 19 of them (50%) had revenues above US $ 2.billion and 9 of them (24%) had revenues of less than US $ 50 million (Exhibit 3 and Exhibit 4).

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<= 50	3	7.9	7.9	7.9
	51 - 99	2	5.3	5.3	13.2
	100 - 249	6	15.8	15.8	28.9
	250 - 499	3	7.9	7.9	36.8
	999 - 1,999	2	5.3	5.3	42.1
	1,999 - 2,000	1	2.6	2.6	44.7
	> 2,000	21	55.3	55.3	100.0
	Total	38	100.0	100.0	

Exhibit 3: Number of employees

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<= 50	9	23.7	23.7	23.7
	51 - 99	1	2.6	2.6	26.3
	100 - 249	4	10.5	10.5	36.8
	250 -499	3	7.9	7.9	44.7
	500 - 999	1	2.6	2.6	47.4
	1,000 - 1,999	1	2.6	2.6	50.0
	>2,000	19	50.0	50.0	100.0
	Total	38	100.0	100.0	

Exhibit 4: Company Revenue ($M)

In line with the previous research on the KMI, we profiled organizations in terms of government/public vs. private. The sample included 31 private and 7 government/public organizations.

5.2 . KMI and Micro Data Analysis

Using Belardo's matrix [13] and OP survey, both, KMI and OP were calculated for each organization and aggregated by sectors. The KMI findings are presented in the next four figures (Exhibit 5 and Exhibit 6 for private sector companies and Exhibit 7 and Exhibit 8 for the public/government sector organizations).

Findings are used to compare the realized and perceived KM indexes for both sectors. All KMI tables present the micro level perspective showing average answers for each individual cell.

Overall Realized	Identification	Elicitation	Dissémination	Utilization	*CSF*
Technology	2.86	3.43	3.23	2.32	*2.96*
Leadership	3.01	3.05	3.24	2.67	*2.99*
Culture	3.32	2.65	2.71	3.13	*2.95*
Measurement	2.61	2.32	2.29	2.15	*2.34*
KMP	*2.95*	*2.86*	*2.87*	*2.56*	**2.81**

Exhibit 5: Aggregated responds and realized KMI index for private sector

Based on those answers, (calculated marginal values represent averages for Knowledge Management Processes (KMP or

Overall Perceived	Identification	Elicitation	Dissémination	Utilization	*CSF*
Technology	4.5	4.57	4.5	3.79	*4.34*
Leadership	4.29	4.21	4.29	4.21	*4.25*
Culture	4.57	3.89	3.93	3.43	*3.96*
Measurement	4.2	3.93	4.14	3.64	*3.98*
KMP	*4.39*	*4.15*	*4.22*	*3.77*	**4.13**

Exhibit 6: Aggregated responds and perceived KMI index for private sector

Knowledge skill) and CSF (or KM readiness)), we calculated realized and perceived KMIs.

Overall Realized	Identification	Elicitation	Dissémination	Utilization	*CSF*
Technology	2.50	2.72	3.33	1.94	2.62
Leadership	2.78	2.50	3.00	2.22	2.62
Culture	*3.22*	*2.50*	*2.50*	*2.94*	2.79
Measurement	*2.54*	*2.17*	*2.06*	*2.44*	2.30
KMP	2.76	2.47	2.72	2.39	**2.59**

Exhibit 7: Aggregated responds and realized KMI index for governmental sector

All KMI values can be found in the southeast corner of each table.

Overall Perceived	Identification	Elicitation	Dissémination	Utilization	*CSF*
Technology	3.94	3.89	4.11	3.61	3.89
Leadership	4.17	4.28	3.94	3.89	4.07
Culture	4.33	4.00	4.00	3.61	3.99
Measurement	3.61	3.78	3.76	3.89	3.76
KMP	4.01	3.99	3.95	3.75	**3.93**

Exhibit 8: Aggregated responds and realized KMI index for governmental sector

The KMIs between sectors follows our earlier findings [13] that the realized KMIs are significantly smaller than the perceived KMIs. Comparing the KMI values by sectors, we can see that realized and perceived scores are slightly smaller for the government/public sector (2.59 and 3.93) compared to those for the private sector (2.81 and 4.13).

Next we discuss a possibility to use KMI as a diagnostic tool for OP and introduce the marginal analysis of KMP and CS factors.

6. DISCUSSIONS

6.1. The KMI as a Diagnostic Tool

In this study we have attempted to validate the claim of a positive correlation between the KMI and organizational performance (OP), using a simple regression model for predicting OP. Significant findings for individual rows and columns, even cells are discussed in the next part of this study. We used 16 questionnaire items to measure OP for the entire sample as well as for each sector. The average OP value for all organizations is 3.37, for the private sector it is 3.42 and for governmental sector it is 3.20.

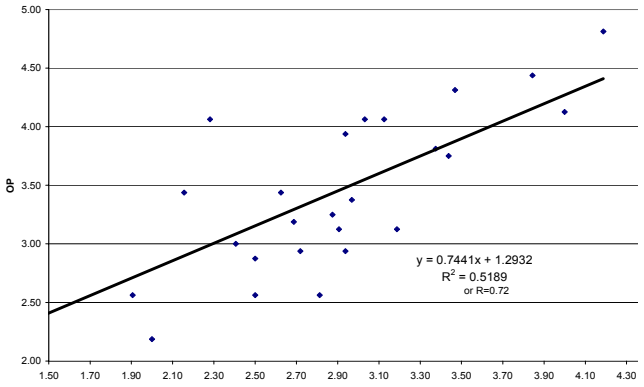

Exhibit 9: OP as a linear function of KMI, OP= *f* (KMI) for the private sector (based on realized KMI)

Calculated KMI values for individual organizations were paired with appropriate OP indices that were used to investigate the KMI-OP relationship. The KMI was re-confirmed as a proxy for firm's performance.

After calculating the realized KMI (KMI(r)) for all data, we plotted the data and used regression analysis to estimate the relationship OP= *F* (KMI(r)). This regression confirmed the previous findings of the positive correlation between the KMI and organizational performance. For the entire sample, the R was found to be 0.61. After splitting the organizations into governmental and private sectors, the picture changed dramatically.

As can be seen from Exhibit 9, the correlation coefficient for thee private sector firms is 0.72 with p = 0.00002. The resulting regression line is OP=0.744*KMI+1.293., . This finding re-confirms our earlier hypothesis that KMI could be used to predict OP.

For the same organizations, perceived KMI(p) was calculated to be 4.13 (Exhibit 6). Applying the previous model, perceived OP should be 4.36. Keeping in mind that the biggest that KMI and OP could be is 5; we adjusted our predicted values by 1%. This will give an adjusted value for OP(4.13) of 4.35.

Our study continued with the next question: Knowing that KMI is a proxy for organizational performance [13], how do the individual components of the KMI impact organizational performance?

Given that when viewing the columns and rows of the matrix there is an overlap of cells, it would be incorrect to try to create a nomological network in which all the eight variables above are considered to be predictors of organizational performance.

Consequently, we proposed and tested two separate nomological networks. We set up both models: OP=F(all knowledge skills) and OP=F(all KM readiness factors) and performed the multiple regression. Initial results were promising (R was 74% and 76% respectively*)* for both models, but p values for independent variables were very high and as a result it must be concluded that the models are not statistically significant. Following that, we examined all possible combinations (10 for each of two models) to trace the individual and sub-grouped influences to OP. The best of all statistically acceptable models were obtained when using regression with a single variable. Correlation coefficients for all these models are presented in the next table, Exhibit 10.

KMP Models	OP=***f***(I)	OP=***f***(U)	OP=***f***(D)	OP=***f***(E)
R=	0.67	0.67	0.66	0.62
CSF Models	OP=***f***(T)	OP=***f***(C)	OP=***f***(L)	OP=***f***(M)
R=	0.74	0.66	0.61	0.57

Exhibit 10: Correlation coefficients for regression models OP = *f* (single factor)

As a result of analysis of Exhibit 10 we can conclude that the individual knowledge processes as framed within the KMI have about the same performance impact, although, elicitation has the relatively lower impact. There are distinct differences among the CSFs: technology has the greatest impact while measurement the least.

6.1 Perceived and Realized Impact of CSFs and KMPs

In this study we investigate the KMI at the micro-level. To assess the influences of individual factors on KMI, we had to introduce a time dimension. To do this we need to analyze the realized and perceived values of all factors. In this context, we present four tables (Exhibits 11 and 12 for the private sector and Exhibits 13 and 14 for the governmental sector).

These tables are constructed using the absolute frequencies of how many times a selected factor was thought to be relatively the most important (max) or the least important (min) in its group; if there was a tie, both answers were counted. Choosing this approach (using the extreme values) is an attempt to include individual answering styles (which is typically lost when using averages) while trying to learn about interconnections between factors in each of two time frames.

Exhibit 11 presents frequencies of realized and perceived opinions about CSFs in private sector.

CSF	Realized		Perceived	
Private org.	Min	Max	Min	Max
Technology (T)	5	9	7	13
Leadership (L)	2	11	4	10
Culture (C)	1	10	12	4
Measurement (M)	21	0	12	3

Exhibit 11: Frequencies of individual answers placing CSF to be Min or Max in the context of time

As can be seen in the first two columns (realized CSFs), Technology was selected to be the least important in 5 organizations, Leadership in 2, and Culture in 1, while 21 respondents felt that Measurement was the least important CSF. It is necessary to emphasize that for individual respondents this minimum (or maximum) could be quiet a big (or small) score.
It is interesting to note that none of the respondents thought that Measurement was the most important factor. The other three CSFs were thought to be most important an equal number of times (9, 11 and 10). For Culture, the really dramatic change is expected in the future. As can also be seen, Technology will gain in importance and Measurement will improve its position, being selected less frequently to be the least important (from 21 to 12). Leadership shows the smallest change between realized and perceived frequencies, but with a general tendency of loosing impact.

In the next table, Exhibit 12, we show our analysis of the Knowledge skills.

Knowledge Skills	Realized		Perceived	
Private org**.**	Min	Max	Min	Max
Identification (I)	6	9	4	15
Elicitation (E)	6	10	10	7
Dissémination (D)	4	8	11	5
Utilization (U)	13	3	11	4

Exhibit 12: Frequencies of individual answers placing Knowledge Skills to be Min or Max in the context of time

The first two columns estimate realized knowledge skills (KMP). Four organizations suggested that the Utilization is overwhelmingly less important than any other Knowledge skill (min = 13). The other skills were rated about the same (6, 6, 4). Comparing the maximum frequencies, Identification, Elicitation and Dissemination were viewed as almost equal in terms of importance (maximums are 9, 10 and 8). Utilization was thought of as being a maximum by only three firms. The next two columns predict knowledge skills for the future, showing the biggest changes for Dissemination. The number of maximums for Identification is expected to jump (60%), while for Elicitation the number of maximums drops (60% less) and the number of minimums rises (64% more). Relative importance for Utilization will remain very low, almost unchanged.

Similar calculations were performed for the governmental/public sector as well and are shown in Exhibit 13 (for CSF) and in Exhibit 14 (for KMP).

Comparing the realized and perceived CSF scores, it can be seen that there are small changes in the importance for the CSFs Technology and Leadership, while the changes for Culture and Measurement are huge and extremely interesting; Culture in very important (0 minimums and 3 maximums). Currently, Measurement can be seen to be the minimum for almost all organizations, but in the future, it will become the maximum for the majority of organizations. Comparing individual answers, all values for perceived Measurement are higher then for the realized Measurement.

CSF	*Realized*		*Perceived*	
Govern.Org.	Min	Max	Min	Max
Technology (T)	0	4	1	4
Leadership (L)	3	2	4	3
Culture (C)	0	3	4	2
Measurement (M)	6	1	1	6

Exhibit 13: Frequencies of individual answers placing CSF to be Min or Max in the context of time

Knowledge Skills	*Realized*		*Perceived*	
Govern. Org.	Min	Max	Min	Max
Identification (I)	2	3	2	3
Elicitation (E)	2	3	1	6
Dissémination (D)	4	3	4	1
Utilization (U)	3	2	4	1

Exhibit 14: Frequencies of individual answers placing Knowledge Skills to be Min or Max in the context of time

The next exhibit to be discussed is Exhibit 14. This exhibit shows frequencies for KMP components. Elicitation is the "big winner" with a net gain of 100% in the number of minimums and a gain of 50% in being the less frequent minimum. Identification is basically unchanged. Both, dissemination and utilization deserve special attention. Dissemination is scored either very high or very low with almost the same number of maximums and minimums for the realized KMP. It looses 75% for the perceived KMP. Utilization is a "net looser, adding one more minimum and loosing one maximum.

7. CONCLUSIONS

Based on data from our survey, we may conclude that by knowing individual factors, managers may be able determine the future OP using the complete KMI model. Also, they may select an individual model for the prediction. If there is expected a considerable change in factors (as noticed in Exhibits 7 thru 10), predictions will become even more complex.

In our analysis, we examined the values of each of the four rows and four columns of Belardo's matrix used to calculate KMI. Depending upon our assessment of these values we drilled down to individual cells in order to help us better understand which factors contribute to successful knowledge management efforts (Exhibits 11 thru 14). Using descriptive statistics we concluded

that all individual cell values for all explored situations fit inside the mean +/-2 appropriate standard deviations. Using the Kruskal-Wallis Rank test with p=0.05, we were not able to reject the hypothesis that all columns (or rows) have the same probability distribution. Using an ANOVA model, we were able to reject only two hypotheses about the equal means for (1) realized CSF factors and (2) perceived KMP factors for the private sector (p=0.05). No other test hypotheses were rejected. Given these conclusions, we attempted to find other ways to determine which of the processes and/or critical success factors are more or less important (have more or less weight) for a given sector.

Based on exhibits 11 through 14, the most interesting area where huge changes are expected is culture, with perceived loosing its importance; loosing maximums and gaining minimums. This is estimated for both sectors. We find this interesting, given the fact that in today's society managers are under pressure to come to terms with problems that result from outsourcing, globalization and mergers and acquisitions. Measurement is another area where big changes are reported, especially in the governmental/public sector organizations.

Selected elements of this research were already accepted with a great interest at four conferences ([13], [21], [22], [24]). Authors had a chance to give several seminars for MBA students and IS/IT professionals in USA and Europe. Our future research will focus on individual industries and what changes firms in a given industry will be required to make (in order to ensure successful knowledge management efforts) leading to improve OP. Before exploring the longitudinal studies, the next research effort will be to do complete validation of the instrument. Initial investigation is on the way and we expect its completion and results shortly.

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