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Abstract
While Knowledge Management (KM) has been shown to be a strategic source of competitive advantage (CA), processes designed at enhancing the productivity of knowledge do not however equally contribute to the organization's capabilities. Consequently, this research, using data collected from the entire population of a firm's personnel in Japan, focuses on the relationship between each mode of the KM process and multiple CAs, and investigates how different perceptions and behaviors on KM affect those CAs. This research-in-progress paper reports preliminary results showing that the perceived importance of KM activities appears as an important source of 'technical competitive advantage', and that more time spent on KM activities contributes to an 'affective competitive advantage'. Further analysis involves a taxonomy of employees based on their perceived importance of and the time they spend on KM. The goal of this research is to identify, among sub-groups by department or function, specific KM processes that can durably increase the firm's competitiveness, and to examine eventually whether KM behaviors have a uniform effect on CA across national borders within the same company.

Keywords: Knowledge Management, Competitive Advantage, SECI, Taxonomy

Introduction

In the field of Business Administration, the paradigm where organizations are regarded as centers of information processing has begun to shift to the paradigm where organizations are regarded as sources of knowledge creation (Nonaka et al. 1996) and where learning has become a key construct defined in terms of outcomes and processes (Argyris and Schön 1992).

Previous research has shown that the creation and transfer of knowledge as well as knowledge embedded in the interactions of people, tools, and tasks provide a basis for CA in firms (Argote and Ingram 2000). Also, the focus on resources that are developed within the organization and difficult to imitate has propelled organizational knowledge as a leading source of CA (Spender and Grant 1996). However, some earlier work on KM and CA put emphasis on description rather than empirical study (Holsapple and Singh 2001) while some more recent research focused on empirical data from several organizations (Chuang 2004). In this regard, we decided to focus on only one firm as no two organizations, even in the same market, are similar enough to display consistent internal characteristics such as KM behaviors.

The objective of this research is to first examine how each mode of the KM process affects a specific firm's CA, and then to identify the relationship between identified sub-groups of workers in the firm and CAs in order to eventually increase the yield of KM. Presently, this

research-in-progress paper describes in section two the theoretical foundation and hypothesis of this research. Then, section three presents the methodology of the questionnaire survey followed by some preliminary data analysis in section four.

Background and Hypothesis
Knowledge-Creation Theory
The premise of the "knowledge creation theory" based on this paradigm is the supposition that all knowledge can be classified in either "tacit knowledge" (Polanyi 1966) or "explicit knowledge". On the one hand, tacit knowledge is cognitive knowledge and is hard to express with language or numbers: for example, beliefs, points of view, technical skills and know-how are all part of tacit knowledge. On the other hand, explicit knowledge is objective and rational knowledge and can be expressed with language or number: texts, equations, specifications and manuals are a few examples.

In the knowledge-creating view of the firm, knowledge is defined as a process of justifying belief toward the truth (Nonaka and Takeuchi 1995). The conversion processes between tacit and explicit knowledge - Socialization, Externalization, Combination, and Internalization, or SECI - help synthesize subjective values into objective and socially shared knowledge. The knowledge-creation process starts with socialization where the tacit knowledge of customers and competitors is acquired through field building. That knowledge is then externalized through dialogue into explicit knowledge to be shared within the firm. Next, the explicit knowledge is in a form appropriate to be diffused throughout the organization and combined with other existing knowledge. Subsequently, the firm's workers internalize these complex sets of explicit knowledge, and then determine the most favorable application to be put in action. The multiple ontological levels - individual, group, and organization - of the company enable the creation of an organizational knowledge-creation spiral.

Recent empirical studies have shown that even though not all KM styles equally impact performance (Lee and Choi 2003; Chuang 2004), both explicit and tacit knowledge should be managed simultaneously towards achieving greater results (Jordan and Jones 1997).
Thus, when an organization is considered a source of knowledge creation, the promotion of the knowledge-creation process expressed by the SECI model becomes an important part of the organization's management.

Hypothesis
While KM is intended to help improve the organization's efficiency, it can also contribute to and be measured through the creation of CA (Chuang 2004). Thus we explore how the employees' opinions about their perceived importance of and the time spent on SECI affect how they rate the contribution of several business practices, making no prior assumption on the existence or strength of the relationships between SECI modes and CAs (Figure 1).
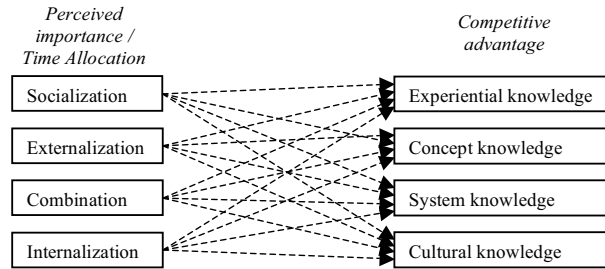
Figure 1: Structural model exploring the relationship between Knowledge Management and Competitive Advantage

This approach is preferred to a bivariate correlation analysis between each step of SECI and each CA as there is no a priori hypothesis on the covariance among the 4 modes of SECI.

Methodology

The analysis is using questionnaire data from a single Japanese pharmaceutical corporation that can be qualified in its industry as a medium size company covering both prescription and over-the-counter drugs. As the organization prefers to remain anonymous, we will refer to it as JPC (Japanese Pharmaceutical Corporation).

JPC recognized the value of KM early on and conducts frequent surveys of its entire global workforce covering topics such as knowledge management behaviors and competitive advantage. The survey has been developed over many years with the collaboration of several professors of Knowledge Management from several Japanese National Universities.

Since we are using here the data of JPC's entire workforce in Japan, or 1,330 people, we can control differences among sub-groups or departments/functions that usually arise in sample surveys. We are focusing on the relationship between KM - SECI - and CA - experience, concept, system, and culture. The questionnaire uses a 5-point Lickert scale. The KM section uses tested questions from established research and includes 6 questions for each of the 4 modes of the SECI process; each question asks for both perceived importance and time allocation, thus making up a total of 48 variables. 11 questions in the survey addressed how employees perceived the contribution of certain behaviors, processes, or instruments at work (Table 1). Those questions were designed to encompass 4 types of knowledge properties pertaining to CA, including experience, concept, system and culture.

Table 1: Scope of questions on Competitive Advantage

| Competitive Advantage	Questions' contents
Experience knowledge property (4 items)	Individual skills and know-how; respect and trust; enthusiasm and competitive spirit; frequent knowledge and experience sharing
Concept knowledge property (4 items)	Concern for quality; company reputation; intellectual property
System knowledge property (3 items)	Policies and procedures; internal databases;
Cultural knowledge property (1 item)	Corporate culture including mission, vision, and values

## Analysis

Introductory statistics

We first looked at the distribution of SECI and the data shows that some type of balance has been achieved among the 4 modes of SECI since the mean of both perceived importance and

time allocation scores, around 3 on the 5-point Lickert scale, appear uniform across all 24 questions (Figure 2). This indicates that the respondents equally value the 4 modes of SECI. However, as SECI's perceived importance ranked consistently higher than its time allocation, we can infer that even though respondents know SECI is important, they don't spend as much time as they think is necessary. The standard deviation across all 24 questions (not shown) ranges from 0.8 to 1.2 and, similarly to the mean, both variables closely follow each other.

Let's now look at correlation scores between the perceived importance of SECI and competitive advantage. They turned out to be significant ($p<0.01$ or $p<0.05$) and to display similar patterns across each of the 4 modes of SECI – S, E, C, and I (Figure 3).
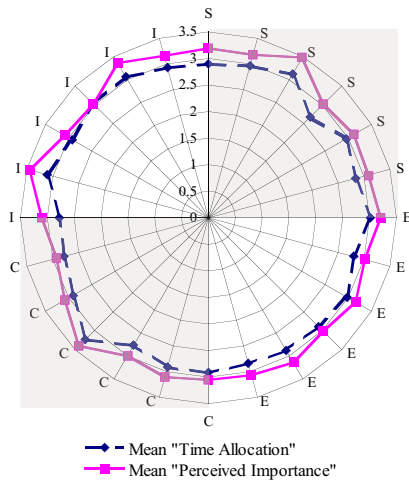
Figure 2: Mean of SECI's perceived importance and time allocation questions
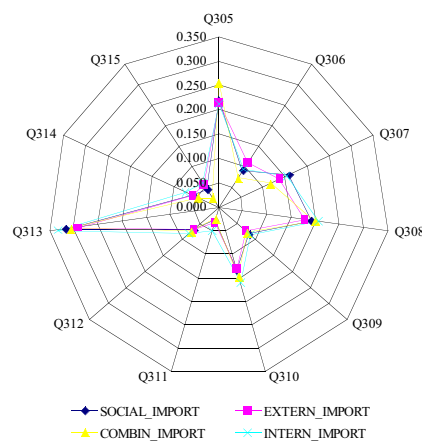
Figure 3: Correlation radar graph of SECI's perceived importance with each question on CA

One question on the experience knowledge property (Q313) - dealing with knowledge and experience sharing among employees advantage - displayed a much higher correlation with SECI than the others, with coefficients ranging from R=0.293 ($p<0.01$) with externalization to R=0.332 ($p<0.01$) with internalization. The next highest correlation was also with another experience knowledge property question (Q305), with a score of R=0.256 ($p<0.01$). As a result, we interpreted that those who found SECI important also ranked the experience knowledge property as important. In other words, SECI appears as the best predictor of experience knowledge property among the 4 competitive advantages investigated here.

While the correlation scores of SECI's time allocation with competitive advantages appear consistent across all 4 SECI dimensions, they tend to be lower than those with SECI's importance with no value above R=0.253 ($p<0.01$). Nevertheless, correlations with questions on the experience knowledge property (Q306 and Q307) ranked consistently higher overall (R=0.253 and R=0.240 with S, $p<0.01$). As a result, more time spent on SECI activities (socialization in particular) benefits the experience knowledge property.

These correlation scores show that SECI's importance and time allocation primarily affect the competitive advantage related to experience knowledge.

Factor analysis and regression model

A factor analysis of the dependant constructs was carried out to ensure that all 11 questions measuring each competitive advantage displayed higher loadings on the intended construct rather than on the other ones. The factor analysis revealed that in fact, the questions on competitive advantages could be grouped into 3 factors different from the intended constructs.

The loadings show that, unlike previously designed, there were 6 questions in factor 1, 3 in factor 2 and 2 in factor 3. Factor 1, with higher loadings on questions Q310, Q311, and Q312 corresponds to *embedded knowledge* available in written documents, databases, and intellectual property. Factor 2, with higher loadings on questions Q306 and Q307 is consistent with *affective knowledge* found in love, care and trust, and the employees' enthusiasm and competitive spirit. Factor 3, with higher loadings on questions Q305 and Q313, clearly contributes to *technical knowledge* related to technical skill and shared know-how. The results of the factor analysis bring us to revise our structural model and change the 4 CAs into the 3 factors defined above.

We first performed a multiple regression analysis with SECI's perceived importance as independent variables and the 3 CA constructs extracted from the principal-component analysis (Figure 4).
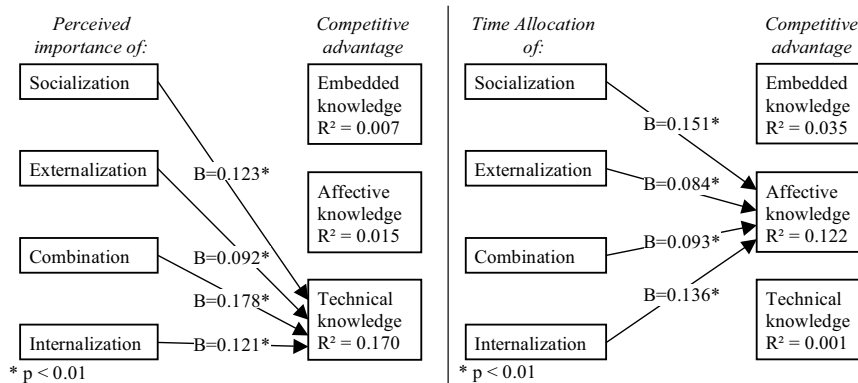

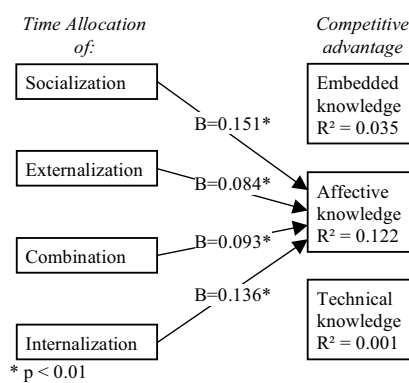**Figure 4: Graphical summary of results for the perceived importance of SECI and CA**

Figure 5: Graphical summary of results for the time allocation of SECI and CA

The explanatory power of the structural model was evaluated based on the amount of variance in the dependant constructs (embedded knowledge, affective knowledge, and technical knowledge) for which the model could account (R^2). The structural model could explain 17% of the variance for technical knowledge, but only 1.5% for affective knowledge and less than 1% for embedded knowledge. The value of the beta coefficient (B) indicates which of the independent variables have a greater effect on the dependent variable in the multiple regression analysis. In our model, all the standardized coefficients are highly significant ($p<0.01$) and combination shows the strongest effect on technical knowledge and externalization the weakest.

As a result, the perceived importance of SECI, especially combination, appears as the most important source of technical knowledge CA.

Next, we carried out a multiple regression analysis with SECI's time allocation as independent variables and the 3 CA constructs (Figure 5). The structural model could explain 12% of the variance for affective knowledge, but only 3.5% for embedded knowledge and virtually none for technical knowledge. In our model, all the standardized coefficients are again highly significant ($p < 0.01$) and socialization shows the strongest effect on affective knowledge and externalization the weakest.

Consequently, more time spent on SECI, in particular socialization, appears as the most important source of affective knowledge CA.

Taxonomy of workers toward KM

As aggregate statistics only give the big picture, we decided to divide the population into a taxonomy based on the respondents' perceived importance and time allocation of SECI. We grouped the answers on SECI's perceived importance together and calculated the mean of the 24 scores for each case; we simultaneously did the same for the answers on SECI's time allocation. Clusters were made according to the mean of each respondent's aggregate score for SECI and labeled as follow.

When the mean of the respondent's aggregate score on SECI'S perceived importance and on time allocation are both equal to or greater than 4, he/she is called a KM *advocate*. When the mean of the respondent's aggregate score on SECI'S perceived importance and on time allocation are both equal to or lower than 2, he/she is called a KM *skeptic*. When the mean of the respondent's aggregate score on SECI'S perceived importance is equal or greater than 4 and that on time allocation is equal or lower than 2, he/she is called KM *busy*. And when the mean of the respondent's aggregate score on SECI'S perceived importance is equal or lower than 2 and that on time allocation is equal or greater than 4, he/she is called KM *hopeful* (Figure 6).
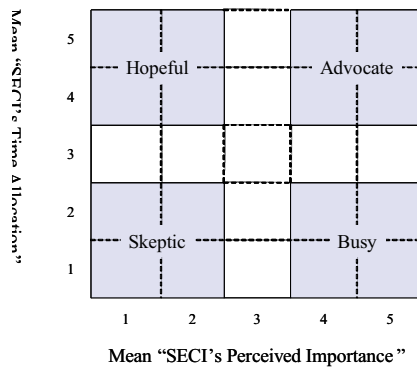
Figure 6: Taxonomy of workers' perceived importance and time allocation of SECI

As the groups in the taxonomy are mutually exclusive, we performed a correlation analysis between those and the 3 competitive advantages constructs extracted from the principal-component analysis. As the data covers the entire population of JPC's workers in Japan, we can reasonably assume that the independent and dependant variables follow a normal distribution, and therefore we can use the Pearson correlation coefficient as the best estimate of the correlation of SECI and CA.

The results in Table 3 indicate that there is a medium negative correlation (R=-0.334, p<0.01) between KM advocates and the contribution of technical knowledge, that there is a medium positive correlation (R=0.302, p<0.01) between KM busy people and the contribution of embedded knowledge, and that there is also an even stronger positive correlation (R=0.473, p<0.01) between KM hopefuls and the contribution of affective knowledge. Also, it is interesting to note that among the population of 1,330 respondents, advocates make up the highest share (516), followed by skeptics (314), busy (98) and hopefuls (60). These 4 categories of people cover about 75% of the entire population of JPC's Japanese operations.

Further analysis will be performed on the data, including taxonomies derived from stricter and looser mean criteria as well as absolute mean scores.

Table 3: Correlation between the taxonomy of workers and the 3 factors of CA

		Factor 1 'Embedded Knowledge'	Factor 2 'Affective Knowledge'	Factor 3 'Technical Knowledge'
Skeptic	Pearson Corr.	.021	.178(**)	-.232(**)
	Sig. (2-tailed)	.300	.000	.000
	N	314	314	314
Busy	Pearson Corr.	.302(**)	-.178(**)	.011
	Sig. (2-tailed)	.000	.000	.755
	N	98	98	98
Hopeful	Pearson Corr.	.027	.473(**)	-.056
	Sig. (2-tailed)	.555	.000	.219
	N	60	60	60
Advocate	Pearson Corr.	.130(**)	.230(**)	-.334(**)
	Sig. (2-tailed)	.000	.000	.000
	N	516	516	516

**Correlation is significant at the 0.01 level (2-tailed)

The discussion will explore the underlying reasons behind the results of the structural model in order to explain the relationship between the perceived importance and the time allocation of KM and the contribution of the 3 CAs – embedded knowledge, affective knowledge, and technical knowledge – derived from the principal-component analysis. Then, we will focus on the results involving the taxonomy of workers on their KM behaviors as well as the differences among sub-groups or departments/functions within the organization.

Future research will also use data from offices of the same company located in other countries to compare whether KM behaviors are uniform across national borders within the same company and whether a relationship between KM and CA exists.

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