

# **An Empirical Research on a State of Knowledge and Knowledge Acquisition Behaviors in Organizations**

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## **Abstract**

Recently, both in academic and business domains, "Knowledge" or/and "Learning" in organizations have been focused on. A lot of psychologist or sociologist have suggested that researcher and practitioner should assume that knowledge is dynamic, is not static when they study about knowledge. However in Management researches, knowledge has been tended to consider it static, such as concepts of "Intellectual Asset" or "Intellectual Capital". And also there are few empirical studies about knowledge in organizations. We attempted to survey from the point of view that was knowledge as a serial utilized activity in real work context, not as an amount of storage. 308 Japanese companies attended. In this paper, we report about knowledge acquisition behaviors in problem solving, and a state of important knowledge in organizations. Former, it was found that workers accessed and used some information sources properly according to situation in order to solve problems. Workers were going to acquire knowledge optimally; case by case. Later, we found that a state of organizational knowledge was not fully specified, especially the knowledge related to innovation was imperfect. Furthermore, as an issue became more and more complex, its resolution was not so smooth and needed more various kind of knowledge. Knowledge such "Change" and "Optimizing" especially needed to be actualized and communicated in Japanese companies. Finally, we will discuss about embodied the scheme, Learning of Workers, for managing knowledge.

## **1. Introduction**

In late years there is a growing tendency for companies to shift from stable hierarchical structure to flat type or taskforce teams centered structure, or to introduce organization formation in which both characteristics are coexisting each other. Some systems of new organization utilizing information technology is studied or applied with a change of organizational formation.

In particular, in the side of human resource management, the systems such as Knowledge Management (Spencer 1995<sup>[1]</sup>, Shum 1998<sup>[2]</sup>), EPSS (Gery 1991, 1995<sup>[3]</sup> <sup>[4]</sup>), e-Learning and Web Based Training have lately attracted considerable attention. Each of these systems is distinguished in terms of differences of its theoretical background or the information and behavior that it targets at, however, their fundamental purposes are same. In other words, all these systems are able to provide appropriate information, which can be taken as "knowledges<sup>†</sup>", through utilizing information technology to process a large quantity of information related to job for the purpose of performance. Moreover, they have something in common, where organization system is considered from the viewpoint of knowledge utilized in a process because it has been considered from the viewpoint of a task and a task process conventionally.

On the other hand, in sociology and cognitive psychology, it is difficult to treat knowledge with information technology. For example, Hutchins (1990<sup>[5]</sup>) pointed out the following from a study of navigation operations of a ship. In various instruments utilized in navigation operations, there are many technologies remained unchanged though they are possible to be replaced with the latest information technology of computers or automated by. For example, such technologies are a compass,

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<sup>†</sup> There is confusion because interpretation of knowledge is different in some fields such as Business Administration, AI, and Psychology. In this study, "Knowledges" is considered as Knowledge that has the wide meaning utilized in Business Administration and Mgt. Information. The information that can be formalized as declarative and procedural knowledge in AI is expressed as "Knowledge".

a telescope, a ball-point pen, a record book, a drafting machine, a chart of Mercator projection, and so on. Technology, that is, crystallization of knowledge indicates not only technological problem but importance of social process. It is recommended to examine how existing technology is utilized in a real world. According to a study of the airport control operations by Suchman (1990<sup>[6]</sup>), the situation becomes the decision factor which a newcomer can learn into job, for example, an information flow of operations is obstructed by a line of desks and the way of making a passage without an artifact for the direct communication such as a telephone and a memo. In other words even if only knowledges is delivered to workplace, all is not communicated, because knowledge is situated in workplace; “Ba”. According to Harada (1997<sup>[7]</sup>), it is impossible to copy the memory keeping "identity" of the contents because the knowledges in individual memory cannot be separated from its acquisition process. The communication and patrimony of knowledges can not be shared and reused immediately by simply formalizing and computerizing the knowledges itself.

It is important to consider knowledges as a social and a cultural problem instead of technological problem when we think about a tool as the computer which is utilized in order to "communicate", "hand down," and "create" knowledges in organization. It is the last purpose not only to improve an individual performance and make an individual learning effective but also to design a frame to aim at building the Learning Organization (Senge 1990<sup>[8]</sup>) where organizational learning and individual learning coexist.

## **2. Purpose**

It is often the case that the learning of workers is happening in practicing job in a workplace besides learning by training in classroom or books (Lave and Wenger1990<sup>[9]</sup>, Wagner et al.1998<sup>[10]</sup>). The learning often comes from processing tasks according to an operations manual and from daily conversations with a superior as well as observing and imitating senior associates. Workers unintentionally learn the useful contents for operations that are placed in actually. And they intentionally learn in order to make up for ability which is not possessed currently and enhance their “Marketability” by acquiring an ability that is necessary for themselves in the future. Students in school learn for the purpose of memorizing an abstract conception as an impracticable theory. On the other hand, workers acquire the essentials from various information sources in order to solve various problems that they come across in interaction with workplace-situation and condition.

The concept as the learning of workers is broader than one of traditional memory-based learning. Their learning behavior changes according to the situation. The learning of workers includes especially some cases. For example, they even memorize where the information source is, called external memory. And they memorize only the essential contents for an actual problem solving, do not memorize the whole of theory. Moreover they need to make it useful for an actual performance. There is actually not so much learning that they entirely memorize what is written in a textbook as it is. Therefore, it should be expressed that workers are acquiring the knowledges according to the various situations rather than that they are learning. And they learn not only contents of information also the adaptive acquisition behavior through practical experiences.

The first purpose of this study is to show various knowledges acquisition behaviors of workers. In other words it is to show an adaptive method to facilitate performance improvement in organizations. The second purpose is to examine creative use of the knowledges acquisition behaviors and the reason. The third purpose is to discuss IT utilization, which is expected to apply to a way of supporting performance improvement, from the viewpoint of knowledge acquisition behavior of workers.

## **3. Approach and Method**

### **3.1 Approach**

This study focuses on knowledge acquisition behaviors. For the study of the learning of workers, it is not enough to examine only a behavior memorizing an external information. Learning needs to be considered in the meaning of adaptive action in the problem solving which is complex, ill-structured and continuous. It includes not only routine mastery also adaptive mastery (Hatano and Inagaki1983<sup>[11]</sup>).

Our perspective is grounded on three scientific studies. Firstly, it is Situated Learning Theory and Activity Theory. People search for necessary knowledge to solve a problem when they encounter some scenes where they cannot solve it. In other words, in such a scene, the automatic processing cannot be adapted. A burden is placed on the competence

system in new situation (Skinner 1995<sup>[12]</sup>). The burden brings them to access some external resources and/or a long-term memory that is not searched yet. It is also required to search for knowledge that is matched to the situation and to adapt the searched knowledge to the situation in order to utilize in problem solving. In problem solving, the advanced cognitive system is to work by a continuous cycle of plan and situated action. According to Gibson (1973<sup>[13]</sup>), "a characteristic of being intellectual" is assumed not to be attributed to the knowledge that people have but to be the characteristic "brought out" as a consequence of interaction of both when "opened" people come across the external world. Furthermore, according to the study on intelligence by Saeki (1990<sup>[14]</sup>), it is important to study what sort of intellectual behavior is explored remarkably in what sort of situation, not to study what sort of "intelligence" people make up in his/her mind. In other words, it is significant to consider the knowledge from the viewpoints of activity and result, not to consider the knowledge itself. Activity is to acquire essential knowledge in the situation where the problem can not be solved smoothly, and result causes by adapting acquired knowledge to an actual problem.

Secondly, it is Memory studies in Artificial Intelligence and Cognitive Psychology. According to Schank (1982,1999<sup>[15][16]</sup>), the knowledge acquisition is to be added afresh by collation with faith on the basis of individual experience, and not to be generated afresh. The learning of workers must be included the restructuring of their knowledge on the basis of past experience such as "Organization (Gregg1986<sup>[17]</sup>)", rather than the addition of new knowledge to an individual knowledge system such as "Assimilation (Piaget1976<sup>[18]</sup>)". Learning through experience of job is the center of learning of workers. Knowledge is acquired, utilized, and generated in workplace where the situation changes by the minute. In other words knowledge is dependent on situation, not static. Even if people acquire the static and general knowledge, it must be informed and transformed to be effective for the problem solving in situation (Neisser1976<sup>[19]</sup>), workplace, and created as a new knowledge. It is hard to say that knowledge is static. Knowledge is dynamic.

Thirdly it is Learning Organization Theory in Business Administration. As we mentioned earlier, individual learning depends on his/her surrounding situation. According to Heijest et al. (1995<sup>[20]</sup>), knowledge in organization is based on a series of individual learning, learning by communication and formation of knowledge-storage. And, according to Kim (1993<sup>[21]</sup>), organizational learning premises individual learning, and these generate synergy and lead organization to learning organization. Learning need to be considered from the viewpoint of not only individual learning also organizational learning and continuous interaction each other (Nakanishi 1998<sup>[22]</sup>). It includes corporate culture, system, climate, daily conversation in addition to the direct competency development activity such training in classroom and OJT. It is necessary to consider the individual knowledge acquisition behaviors in organization from above viewpoints. There is a difficulty to study a tacit knowledge because it is insistently tacit and not definite. Knowledge is considered from the viewpoint of the information process (Ruggles1998<sup>[23]</sup>, Holthouse1998<sup>[24]</sup>) that indicates what kind of information source is utilized to solve problem because knowledge is dynamic even if it is definite.

## 3.2 Methods

### (1) Development of the questionnaire

In present study, we developed and used a questionnaire included three questions; "Utilization of sources (tools) in dealing with issues", "Smoothness of solving each issue", and "A state of knowledge in organizations".

#### a) Utilization of sources (tools) in dealing with issues

We developed 25 items as information sources in dealing with issues based on our pre-researches. Each item was measured regarding each issue by five point scale, "Dealing with a problem, how frequently do workers in your company utilize or access these sources in workplace?" (1. don't access, ~ 5. always access).

#### b) Smoothness of solving issue

We set four types of issue. These were measured with seven point scale, "How smoothly can workers in your company solve a issue?". Each issue was measured with seven point scales (1. never smooth ~ 7. very smooth). Each issue was instructed to subjects with two or three lines.

Here, we describe about each issue. It is thought that information sources to be utilized must be change by the situation of issue. We have roughly classified two types of issue, the former was related to present work directly as performance improvement, the latter was related to present work indirectly as competency development. And, about the former, I divided it into three phases by complexity in issue that is degree of being structured.

"Four types of issue" is following (Table1)

- ① Issue type1 (TS; Trouble shooting on operational task) : The issue arose in the operational task or sub task of

which objectives and procedures are fixed or definite. And the task unit, which can be finished in a short time, is small.

- ② Issue type2 (PS; Problem Solving) : This issue that is arose in the job or task of which objectives are fixed but its process and procedure are not fixed or definite. This type will be expressed by some examples such as developing new proposal to customers, meeting the customers' complaints, and analyzing the products of the competitors. Each task is consisted of some sub tasks.
- ③ Issue type3 (GS; Goal Setting and/or Strategy Formulation) : The characteristic of the issue is that both objectives and process are not fixed. For example, it indicates long term business planning, setting goal for the year or half a year, and organizing a new project. The issue demands of workers a concrete team policy and action plan from the viewpoints of a long term.
- ④ Issue type4 (CD; Competency Development) : It is to learn competency and skills which workers need to develop one's marketability for his/her career success or future.

<i>Issue type</i>	<i>Objectives</i>	<i>Process</i>	<i>Focus</i>
Type1: Trouble shooting on operational task	Fix	Fix	Sub task & Task
Type2: Problem solving	Fix	Flexible	Task and job
Type3: Goal setting and Strategy formulation	Flexible	Flexible	Relation with job and Organization
Type4: Competency development	Flexible	Flexible	Relation with Self and organization

Table1 Issue Type

c) "A state of knowledge in organizations"

As for knowledges in organizations, we set it up based on the human competency list developed by Rothwell (1996,1999<sup>[25][26]</sup>) from the standpoint of changing organization and improving human performance. Because there are too many items in the list for the study, we selected 32 items out of them. So these items belonged to a king of skill and ability, we added eight items related to "knowledge".

We took in Bohn (1994<sup>[27]</sup>) 's idea of the information level in organizations in order to measure a state of organizational knowledges. And we made a scale on the basis of this information level. The Information Stage by Bohn shows a state how knowledges can flow and spread in a organization (Table2) .

<i>Stage</i>	<i>Name</i>	<i>Typical from of Knowledge</i>	<i>Current study scale</i>
1	Complete ignorance		1
2	Awareness	Nowhere	2
3	Measure	Tacit	3
4	Control of mean	Written	4
5	Process capability	Scientific method feasible	5
6	Process characterization	Local recipe	6
7	Know why	Science	7
8	Complete Knowledge	Nirvana	No setting

Table2 Information Stage

See: P63, Bohn(1994);We added a row of "Current study scale"

## (2) Method

We sent the questionnaire to 2000 Japanese companies and collected their replies by mail. The investigation period was from January to February, 2000. The withdrawal quantity and rate are 308 and 10.3%.

## 4. Analysis and Result

### 4.1 Result 1: Issue type and knowledge acquisition behaviors

Every four issues, utilization of each information and/or knowledges source was showed in Table3 and 4. That is to say, it means where people acquire necessary knowledge in issue. In the left of table3, we showed top five sources with marks in each issue. In all issues, the degree of utilization of "Advice of superior or OJT leader" is high. On Issue type1, Job specification and Manual, which have common characteristic to be definite and domain-specific knowledge,

were marked high score too. Issue type2 tends to have been similar to Issue type1. But Issue type2 was also marked high score in "Opinion" and "Interview", and so, workers tended to utilize the sources that were not described and formalized. On Issue type3, it characterized type3-behavior by access the knowledges acquired from "Consultation to the other section" and "Industry journal" which existed in both the inside and outside of one's workplace. On Issue type4, "Published book", "Journal" and "Training and Correspondence education "were marked high score. It means that the workers access to these sources to acquire general and common knowledge.

	Ave.	SD	N	Ave.	SD	N	Ave.	SD	n	Ave.	SD	n
Correspondence edu.: Company Specific K/S	1.69	0.98	299	1.64	0.86	300	1.64	0.89	298	2.04	1.19	302
Correspondence edu.: Management K/S	2.03	1.02	300	1.97	0.94	300	1.99	0.96	297	2.62	1.11	302
Correspondence edu.: Qualification or Info. Literacy	2.14	1.10	301	1.94	0.94	301	1.93	0.95	297	2.71	1.13	303
Correspondence edu.: Occupational Specific K/S	2.16	1.04	298	2.05	0.98	300	1.94	0.97	298	2.63	1.11	302
Training in classroom: Company Specific K/S	2.94	1.09	299	2.76	1.07	301	2.44	1.07	299	2.90	1.14	304
Training in classroom: Management K/S	2.74	1.04	301	2.75	0.95	300	2.74	1.07	299	<b>3.10</b>	0.98	302
Training in classroom: Qualification or Info. Literacy	2.24	0.98	299	2.25	0.96	298	2.24	1.00	297	2.67	1.08	301
Training in classroom: Occupational Specific K/S	2.81	1.09	299	2.74	1.01	302	2.61	1.10	299	2.97	1.08	302
Others' Opinions in Meeting	3.19	0.97	300	<b>3.28</b>	0.99	302	<b>3.36</b>	0.99	301	2.81	1.02	299
Advice of Superior or OJT Leader	<b>3.88</b>	1.02	301	<b>3.70</b>	1.03	304	<b>3.35</b>	1.05	301	<b>3.31</b>	1.03	302
Job Specification	<b>3.56</b>	1.10	303	<b>3.21</b>	1.15	304	2.47	1.15	300	2.60	1.18	302
Functional Specific Manual	<b>3.24</b>	1.11	301	3.01	1.12	302	2.46	1.11	300	2.66	1.13	302
Business Duties Manual or Job Description	<b>3.24</b>	1.12	301	2.99	1.15	303	2.53	1.09	299	2.56	1.10	301
Case-book of Fellow Workers	3.05	1.03	301	3.18	1.03	303	3.00	1.05	299	2.80	1.04	300
Formal Interview with the Superior	3.03	0.99	301	3.17	1.01	303	<b>3.20</b>	1.05	302	3.02	1.00	303
Informal Interview with the Superior	3.09	0.97	301	<b>3.23</b>	1.02	303	3.13	1.07	300	2.87	1.03	302
Observation of Behavior of Experts at Workplace	<b>3.24</b>	0.97	302	<b>3.30</b>	1.00	302	3.00	1.04	299	3.01	0.99	301
Advice or Recommendation from Others	3.12	0.89	301	3.13	0.89	302	2.96	1.04	300	2.82	0.93	301
Consultation or Question to the Other Section	3.02	0.91	301	3.18	0.92	303	<b>3.19</b>	1.00	302	2.77	0.96	301
Information Made by Oneself in Own PC	2.72	0.99	298	2.69	0.99	301	2.64	1.04	299	2.41	1.01	301
Information Made by Others in Groupwear	2.55	1.03	297	2.57	1.02	301	2.55	1.09	298	2.46	1.04	300
Information on WWW	2.40	1.04	299	2.42	1.10	302	2.59	1.18	300	2.67	1.12	301
Published Books	2.92	0.91	301	2.95	0.93	303	3.10	1.06	302	<b>3.45</b>	0.94	303
Trade paper or Industrial Journals	3.07	0.98	301	3.06	1.01	303	<b>3.17</b>	1.09	302	<b>3.40</b>	0.95	304
Academic Journal or Books	2.78	0.96	301	2.80	1.00	303	2.92	1.09	303	<b>3.15</b>	1.03	304

Table3 Utilization of Knowledge Sources

	Issue Type1 :TS	Issue Type2 :PS	Issue Type3 :GS	Issue Type4 :CD
Correspondence edu.: Company Specific K/S	-0.004 *	0.138 *	<b>0.236</b> **	<b>0.247</b> **
Correspondence edu.: Management K/S	0.021 *	0.095	<b>0.218</b> **	<b>0.311</b> **
Correspondence edu.: Qualification or Info. literacy	0.016 *	0.129 *	0.184 **	<b>0.302</b> **
Correspondence edu.: Occupational Specific K/S	-0.077 *	0.070	0.180 **	<b>0.301</b> **
Training in classroom: Company Specific K/S	0.102 *	0.187 **	<b>0.321</b> **	<b>0.358</b> **
Training in classroom: Management K/S	0.069 *	0.169 **	<b>0.256</b> **	<b>0.319</b> **
Training in classroom: Qualification or Info. literacy	0.014 *	0.165 **	<b>0.230</b> **	<b>0.397</b> **
Training in classroom: Occupational Specific K/S	0.098 *	0.172 **	0.163 **	<b>0.248</b> **
Others' Opinions in Meeting	0.128 *	0.156 **	<b>0.311</b> **	0.122 *
Advice of Superior or OJT Leader	<b>0.229</b> **	<b>0.226</b> **	<b>0.256</b> **	0.112
Job Specification	<b>0.253</b> **	<b>0.226</b> **	<b>0.292</b> **	0.170 **
Functional Specific Manual	<b>0.216</b> **	<b>0.237</b> **	<b>0.265</b> **	0.174 **
Business Duties Manual or Job Description	0.191 **	<b>0.242</b> **	<b>0.235</b> **	<b>0.214</b> **
Case-book of Fellow Workers	0.177 **	0.165 **	<b>0.227</b> **	0.165 **
Formal Interview with the Superior	0.147 *	<b>0.202</b> **	<b>0.345</b> **	0.187 **
Informal Interview with the Superior	0.197 **	0.154 **	<b>0.259</b> **	<b>0.211</b> **
Observation of Behavior of Experts at Workplace	0.118 *	0.170 **	0.104	0.101
Advice or Recommendation from Others	0.147 *	<b>0.248</b> **	0.188 **	0.174 **
Consultation or Question to the Other Section	0.124 *	<b>0.201</b> **	<b>0.263</b> **	0.171 **
Information Made by Oneself in Own PC	0.122 *	0.152 **	0.183 **	<b>0.234</b> **
Information Made by Others in Groupwear	0.078	0.112	0.172 **	0.190 **
Information on WWW	-0.018	0.092	0.163 **	<b>0.282</b> **
Published Books	0.023	0.129 *	0.184 **	0.180 **
Trade paper or Industrial Journals	0.016	0.149 *	0.195 **	0.149 *
Academic Journal or Books	-0.018	0.123 *	0.140 *	0.161 **

Table4 Correlation between Knowledge Source and Smoothness

At **Table4**, we described the correlation with the degree of “utilization” and “smoothness of dealing with issues”. The part of more than .200 correlation coefficient were plaited and netted chignon. On issue type1 and type2, we see from this table that there was little relationship between the acquisition behaviors and smoothness of dealing with it. On the other hand, there was some correlation on issue type3 and type4 though it was not high enough.

Hence, the more complex an issue became, the more needed to resolve external were (**Table5**) . Particularly we assert even if the sources such like training and education are not much utilized in each issue currently, these are related to smoothness of complex issues that means "chaos", not well-structured problem.

<i>Type1:TS</i>	<i>Type2:PS</i>	<i>Type3:GS</i>	<i>Type4:CD</i>	Ave.(sd)
4.89(1.15) n=293	4.26(1.02) n=291	4.15(1.21) n=288	4.26(1.25) n=291	

**Table5** Average of Smoothness of Solving 4 Issue Types

#### 4.2 Result 2: A state of knowledges and Correlation with knowledges and solution

There were so many items about a state of knowledge in organizations that we reduced variables with factor analysis in order to understand it intelligibly. First, we reduced 40 items of knowledges to 31 items (Equamax rotation, 59.6%) . Then, 6 factors were extracted by second factor analysis (Equamax rotation, 61.4%) . Each factor was named as follow (**Table6**) ;

**Table6** Factor Analysis : Knowledges in Organizations

	Factor					
	1	2	3	4	5	6
Deep Expert Knowledge about Product and/or Technology of this Company	.814	.078	.215	.128	.101	.232
Broad Declarative Knowledge about Product and Technology of this Industry	.784	.175	.145	.201	.279	.148
Deep Expert Knowledge about Specific Product and/or Technology of this Industry	.756	.185	.113	.167	.337	.136
Broad Declarative Knowledge about Product and Technology of this Company	.699	.068	.295	.098	.024	.321
Standards Identification	.151	.647	.066	.245	.220	.216
Process Consultation	.093	.611	.239	.150	.131	.280
Performance Gap Analysis	.072	.610	.168	.267	.148	.306
Analytical Thinking	.124	.592	.137	.368	.257	.205
Workplace Performance, Learning Strategies, and Intervention Evaluation	.212	.591	.321	.158	.209	.129
Intervention Selection	.258	.496	.279	.158	.219	.159
Goal Implimentation	.228	.142	.776	.154	.128	.154
Evaluation of Result aganist Organization Goals	.205	.151	.635	.184	.101	.128
Visioning	.167	.213	.614	.103	.269	.084
Leardership	.196	.169	.599	.368	.116	.194
Business Knowledge: Demonstraing Awerness of Business Function	.152	.356	.415	.108	.372	.159
Facilitation: Helping Others to Discover New Insights	.194	.320	.146	.610	.208	.265
Adult Learning: Understanding How Adult Learn and How to Use Knowledge, Skills, and Attitude	.148	.266	.224	.604	.103	.180
Coping Skills	.152	.144	.132	.559	.477	.260
Buy-in/Advocacy: Bulding Ownership and Support for Wprkplace Initiatives	.162	.227	.323	.546	.170	.070
Communication Networks	.109	.106	.214	.537	.404	.164
Interpersonal Relationship Building	.142	.110	.178	.532	.464	.159
Informal Knowledge about Human Relations in this Company	.220	.219	-.04	.454	.414	.234
Consulting: Providing Insight into How they can Best Use their Resources to Achieve Goals	.149	.203	.229	.353	.598	.186
Knowledge about "Experts" of this Company	.285	.212	.037	.317	.587	.234
æ the "Big Picture": Identifying Trends and Paternns that are outside and the Normanl Paradige of the Organization	.193	.199	.277	.211	.575	.185
Identification of Critical Business Issue	.191	.373	.336	.141	.437	.266
nowledge Management: Developing and Implimenting Systems for Creating, Managing, and Distributing Knowledge	.234	.315	.196	.128	.416	.256
Industry-Specific Practical Knowledge	.160	.208	.015	.159	.261	.822
Company-Specific Practical Knowledge	.150	.167	.077	.159	.117	.770
Industry-Specific Procedural Knowledge	.394	.167	.269	.116	.172	.548
Company-Specific Procedural Knowledge	.423	.095	.395	.061	-.02	.493
Equamax Rotation	Proportion(Eigen-value)					
	42.2(3.5), 6.1(3.2), 4.5(3.6), 3.9(3.1), 2.7(3.1),					

Factor 1 "Domain-specific technical knowledge (Tech-knowledge :  $\alpha = .917$ ) "

Factor 2 "Job analysis and Kaizen (Analysis :  $\alpha = .881$ ) "

Factor 3 "Leadership by vision and goal (Leadership :  $\alpha = .852$ ) "

Factor 4 "Climate facilitation for change (Change :  $\alpha = .885$ ) "

Factor 5 "Resources optimizing (Optimizing :  $\alpha = .846$ ) "

Factor 6 "Practical knowledge at workplace (Workplace knowledge :  $\alpha = .837$ ) "

Table7 showed the average of these six compound variables. As a whole, each Information level as state of knowledges was not so high. "Tech-knowledge (Ave.= 3.78) "and "Leadership (Ave. = 3.65) " were relatively high. While "Optimizing (Ave. = 2.83) "and " Change (Ave. = 2.61) " were less than 3.0 , and very low.

Finally, we examined whether dealing with issue had relation with an information level of knowledges in organizations (Table8) . If related to, it may imply that information level of knowledges is higher, it makes them easier to resolve a issue. As a result correlation coefficient is not so high. But an issue was more complex, much more knowledges were needed, and correlation coefficient became a little higher.

<i>Tech-knowledge</i>	<i>Analysis</i>	<i>Leadership</i>	<i>Change</i>	<i>Optimizing</i>	<i>Workplace knowledge</i>	Ave.(sd)
3.78(1.27) n=299	3.04(1.10) n=301	3.65(1.13) n=300	2.61 (.96) n=299	2.83(1.03) n=301	3.42(1.18) n=299	

Table7 Average of "a State of Knowledges"

Peason-Correlation	<i>Type1 :TS</i>	<i>Type2 :PS</i>	<i>Type 3 :GS</i>	<i>Type4 :CD</i>
Tech-knowledge	0.137 *	0.205 **	0.210 **	0.174 **
Analysis	0.044	0.098	0.127 *	0.169 **
Leadership	0.206 **	0.184 **	0.312 **	0.226 **
Change	0.107	0.124 *	0.118 *	0.164 **
Optimizing	-0.054	0.021	0.168 **	0.087
Workplace knowledge	0.107	0.129 *	0.136 *	0.116

Table8 Correlation between "Issue Types" and "a State of Knowledges"

## 5. Conclusion

In result 1, it was found that workers accessed each information source properly according to situation such issue types discussed earlier. They are going to acquire knowledges optimally, sometimes from others, manual or learning contents. By Issue type1 to type3 premised on performance improvement, as an issue becomes more complex, workers take to access from non-interactive resources described by documents to interactive resources in order to acquire knowledges out of others. The continuum seemed to exist in these knowledge acquisition behaviors (Fig.1) . Davenport (1998<sup>[28]</sup>) distinguished these knowledge as "Articulated vs. Not Articulated".

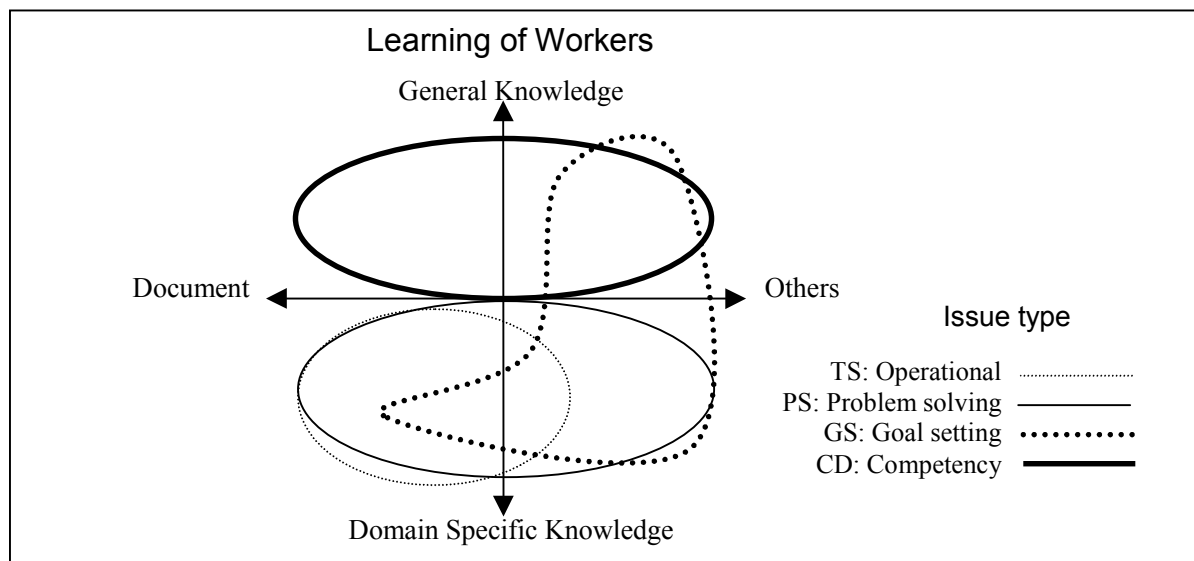
In this case, accessing to others implies that workers not only acquire knowledges possessed by others but also find and create new knowledges within interaction with others. In other words workers do discover the knowledge in dynamics, rather than do not acquire the static knowledge. We can interpret this reason in the following way. From the viewpoint of quality of knowledges, it is pointed out that workers tend to access to general knowledges as situation become more chaos, rather than access to the specific knowledges in a company's or workplace's domain. As an issue becomes ill-structured, workers utilize both of knowledges at same time, the specific knowledges of the domain and the general knowledges to face to their tasks. Workers may extract their own belief from their work experience by learning general knowledges and can communicate their experience just like general knowledges. On the other hand, workers are able to interpret and transform general knowledges in order to make them useful for the concrete issue resolution in real world, workplace.

Next, as for Issue type4 indicating competency development, it was distinguished from type1 and type2. It is not on

the continuum. The research concerned with knowledge utilization by Menon and Varadarajan (1992<sup>[29]</sup>) is useful to understand the difference in learning behaviors between competence development and performance improvement. The former is “knowledge enhancing use”, and the latter is “action oriented use”. But, in dealing with a complex issue as goal setting, workers need to acquire both of knowledges. It is not doubt that the knowledges cultivated through their own experience is important. Moreover the general and external knowledges which is not existed at workplace is important in complex issues and innovation. This agrees with a position of organization knowledge research of Probst et al. (1998<sup>[30]</sup>) . Depending on only past experience, a manager cannot accomplish “Changing role” such as goal setting and/or strategy formulation. In Issue type4, training and correspondence education were not utilized much, but correlation with real world issue resolution showed to be relatively high comparing with the other sources.

From this result, we can say that the systems, which make practical use of these sources possible in workplace, will be pursued in near future. This might be the direction of practical using IT in Knowledge Management.

Fig.1



In result 2, we made it clear on the basis of Bohn model about a state of knowledges in Japanese organizations. At first, we found that a state of organizational knowledges was not fully specified, especially the knowledges related to innovation was imperfect. Furthermore, as an issue becomes more and more complex, its resolution is not so smooth and needed more various kind of knowledges. From the results 1 and 2, we should note that knowledges such "Change" and "Optimizing" needs to be actualized and communicated for the another first step toward knowledge management practice.

Lastly, we point out that there is partly disagreement with accessing sources and effective sources for issues resolution. To take some example, the sources, related to "learning contents" and "case of others' experience", were marked high score as effective one, but also marked low score as accessing one. It seemed that such a disagreement occurred for the reason that these sources were not considered to be easy to make good use in practice; ①knowledges not formalized yet in workplace, ②knowledge communication tools not including learning contents, and ③few examination about relationship with knowledges and tasks that workers should accomplish.

An issue resolution process varies with an artifact greatly. Artifact as cognitive tools must afford "the effectiveness that the artifact is useful for the real-world problem solving" in order to accept socially and culturally to workers. And workers need to interpret and translate the acquired knowledge, because of adapting it to real world issues. When there are relationship with a acquired knowledges and a task or a role, it is easy to take "affordance" and "interpretation". It is very expected that only knowledges to be related to substantially should be chosen and delivered for workers among various information sources with information technology.

Mizoguchi and Ikeda (1997,1999<sup>[31]</sup><sup>[32]</sup><sup>[33]</sup>) have been illustrating the importance that research type in knowledge science and technology should be sift from "Form-oriented" to "Content-oriented". The future direction of this study will be ontology engineering approach for knowledges and human competency in organizations in order to integrate some systems just like KM, EPSS, and e-Learning.



## References

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- [1] Spencer,L.M. 1995 Reengineering human resources. Wiley.
- [2] Shum,S.B. 1998 Negotiation the construction of organizational memories. In Information technology for knowledge management. Springer.
- [3] Gery,G. 1991 Electronic performance support systems. Gery performance press.
- [4] Gery,G. 1995 Attributes and behaviors of performance-centered systems. Performance improvement quarterly vol,8(1).
- [5] Hutchins,E. 1990 The technology of team navigation, in Intellectual team work. Lawrence Erlbaum associates.
- [6] Suchman,A.L. 1987 Plans and situated actions. Cambridge Univ. press.
- [7] Harada,E. 1997 Artifact studies from the viewpoint of human side. (In Japanese)
- [8] Senge,P. 1990 The fifth disciplin. The art and practice of the Learning Organization. Doubleday.
- [9] Lave,J. and Wenger,N. 1991 Situated learning. Cambridge Univ. press.
- [10] Wagner et al. 1999 Tacit knowledge in sales. In Tacit knowledge in professional practice. LEA.
- [11] Hatano,G. and Inagaki,K. 1983 Culture and cognition. Basic psychology,vol.7. Tokyo Univ. press. (In Japanese)
- [12] Skinner,E. 1995 Perceived control, motivation and coping. SAGA.
- [13] Gibson,E.J. 1979 The ecological approach to visual perception. LEA.
- [14] Saeki,Y. 1990 Active mind. Tokyo University press. (In Japanese)
- [15] Schank,R. 1983 Dynamic memory. Cambridge Univ. press.
- [16] Schank,R. 1999 Dynamic memory revisited. Cambridge Univ. press.
- [17] Gregg,H.V. 1986 An introduction to human memory. Routledge & Kegan Paul Limited.
- [18] Piaget,J. 1976 Le comportement, moteur de l'évolution. Gallimard.
- [19] Neisser,U. 1976 Cognition and reality. W.H. Freeman and company.
- [20] Heijest,G.v. et al. 1995 The lessons learned cycle. In Information technology for knowledge management. Springer.
- [21] Kim, D.H. 1993 The link between individual and organizational. Sloan management review, Fall.
- [22] Nakanishi,A 1998 A study of human resource development from the view of "Learning Organization". Journal of Japan association for management system,vol.15(1).
- [23] Ruggles,R. 1998 The state of notion: knowledge management in practice. California management review,vol,40(3).
- [24] Holtshouse,D. Knowledge research issue. California management review,vol,40(3).
- [25] Rothwell,W.J. 1996 ASTD Model for human performance improvement. ASTD press.
- [26] Rothwell,W.J. et al. 1999 ASTD Model for workplace learning and performance. ASTD press.

- 
- [27] Bohn,R.E. 1994 Measuring and managing technological knowledge. Sloan management review,1994 fall.
- [28] Davenport,T,H. 1998 Working knowledge. HBS press.
- [29] Menon,A. and Varadarajan,P.R. 1992 A model of marketing knowledge use within Firms. Journal of marketing,vol.56.
- [30] Probst,G. et al. Knowledge as a strategic resource. In Knowing in firms. SAGA.
- [31] Mizoguchi,R. and Ikeda,M. 1997 Ontology engineering. Journal of Japanese society for artificial intelligence,vol.12(4) .
- [32] Mizoguchi,R. 1999 Ontology: Foundations and applications. Journal of Japanese society for artificial intelligence,vol.14(6).
- [33] Mizoguchi,R., Ikeda,M. and Kitamura,Y. 1999 Foundation of ontological engineering. Journal of Japanese society for artificial intelligence,vol.14(6).