

A Basic Study of Knowledge Management : Classification of Human Knowledge

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Abstract

Recently, studies or researches of Knowledge Management (KM) are doing well and their aim seems to be making business competence of organizations. However, the final results of KM must provide us not only business competence but wonderful and happy life and society. And knowledge and/or information must become inexhaustible resources as prominent scientists such as Drucker and Toffler predicted.

This paper tried to build up a new core frame for KM research a multi-disciplinary attitude. Utilizing wisdom of several fields of psychology, we made clear new definition of data, information and knowledge. Furthermore, four sub-categories of knowledge were derived. Although our result might be unique one, it would accelerate development of KM researches, because our frame would be able to cover all of human factors as knowledge.

1 . Background

It has already passed many years since some famous socio-economic theorists, such as Peter Drucker and Alvin Toffler, said that information or knowledge must be the final and inexhaustible resource for the humanity. Actually, in the last few decades, computer and telecommunication technolo-

gies have made a remarkable progress, becoming already unified and merged, despite of many complications. Today, the progression and unification of these technologies have enabled us to utilize them for support our various tasks, jobs and activities. In other words, what is called Information Systems (IS) has been appeared and we have got an ability to construct and to utilize them for our daily activities.

Certainly by now, IS has become one of the most useful and indispensable tools for our everyday activities. However, have we already gained the final inexhaustible resource in our hands? Regretfully we have not got yet. There are a lot of evidences of our unfinished work. One of the most typical examples is a fact that it is almost impossible for us to control and/or manage our knowledge to create useful new ideas or to make solutions for various problems occurred in our society and everyday life.

From the early 1990s, the study for knowledge began, being often called "Knowledge Management (KM)." This sort of study has mainly headed to achieve competence of organizations and/or companies, and it is a fact that although there are many remarkable results, most of them seem to require some prerequisite to show their usefulness.

Before considering KM, we are going to review the history of IS. During the 1960s, we began to use computers to perform calculation for wages or science simulations. This adoption of computer provided us high efficiency, so that many managers planned to extend fields supported by computer, but most of their trials failed. The main reason of their failure was that they did not recognize the need of changing procedures or the processes of their jobs, tasks and works. Possibly, they recognized it, but at least, they did not want to change their traditional practice. However, after failing repeatedly and wasting a lot of money, by the end of the 1980s, we developed the methodology to use computers for supporting our complicated jobs,

tasks and works effectively. The methodology for constructing IS set the human beings as the leading part of a system and enabled computers to show their superior abilities effectively, such as accuracy, strictness, rapidity, etc. So that we have become to be able to use computers in our complicated work, in which many related tasks are included. However, the range of tasks supported by IS were limited to everyday tasks rather than creative tasks.

Although the methodology for constructing IS does not reach our creative tasks, it seems to suggest three important points, that could be usually overlooked : first, concrete functions provided by IS must differ within organizations, so we have to consider their culture or climate to design proper IS architecture ; second, it's necessary to win consensus of new systems from members of organizations ; and third, if there is no education, training, and at least explanation, the newly constructed IS should fail. In other words, even though very careful designing and writing computer programs can be perfectly performed, IS would not work without considering various human factors.

To tell the truth, the methodology for constructing IS resulted from practical research and not from academic study. For this, it is organized with wisdom of various fields.¹⁾ Among them, what we must pay the most careful attentions must be "Human Engineering." The basic direction of human engineering is that regarding relations between human and machines as a whole system, we have to analyze it and research into it with a sense of multi-discipline, covering medical science, psychology, physical science and engineering. The pragmatic multi-disciplinary research results in the methodology for constructing IS.

We will return to consideration of KM. It is obvious that an object of KM is the intellectual activities of human beings, such as thinking, analyzing,

understanding, and so forth. And at the same time, it should be natural that KM is an extension of IS. Therefore, we have to pay much attention to various wisdom with multi-disciplinary sense as same as previous effort to complete methodology of constructing IS. Incidentally, the following sentences are quoted from Michael J. Earl.²⁾

This inductive analysis also suggests that knowledge building is a multifaceted endeavor. At its simplest, it requires a combination of technological and social actions. ... For a business to build a strategic capability in knowledge, the proposition is that at least four components are required. Knowledge systems, networks, knowledge workers and learning organization

And Laurence Prusak said as follows.³⁾

Various analysts, philosophers, and practitioners have been studying the other factors of production (land, labor, and capital) since at least the fifteenth century. Not unnaturally, there are at this stage in our understanding few things we don't know about their management. However, it is only since the end of World War II that the systematic study of knowledge as an economic force has taken place. Therefore, it is not surprising that we still do not have through and robust models and approaches to aid us in making our knowledge bases more effective and efficient. And while some business people might question the value of academic analysis in this area, their work is essential to gaining a clear and comprehensive understanding of how knowledge "works" within an organization.

As Laurence pointed out, academic various results of related study fields must form the most basic foundation of KM research. Furthermore, as Earl said, it's necessary to organize various results into one system.

2. The Aim of This Research

The Aim of this research is to build up a new core frame for KM research with a multi-disciplinary attitude. To do that, we are going to pay attention to some works of psychology. Using them, we are going to make clear definitions of several concepts such as data, information and knowledge, and also going to classify knowledge into several sub-categories. In addition, some consideration to the relation between knowledge and intellectual activities will be done.

3. Definitions with Clear Distinction

On most of the present research or study for KM, the differences between data, information and knowledge are vague. In many cases, they are distinguished with degree of usefulness, and the boundary between them is not clear. However, it is obvious that the usefulness or importance of some sort of intellectual resource such as data, information and knowledge, must vary according to situations, timing and the aim of people who want to use them. Therefore, definitions based on the degree of usefulness and definitions without clear distinction might mislead researches and/or studies.

In our everyday conversation, it must be impossible and a waste of time to distinguish the meaning of the term "knowledge" from the term "information", and the meaning of the term "information" from the term "data". However, to complete the study and research of "KM", at least these three terms must be defined clearly.

There is another reason for clear definitions. In the "KM" research, our basic attitude must be multi-disciplinary. So, we have to pay attention, at least, to three fields simultaneously : first, some fields concerning human

such as cognitive psychology, group psychology, social psychology, behavioral science, etc ; second, fields concerning organizations and/or companies such as management and organization theory ; third, fields about computer and communication and media such as computer science, communication theory and media theory. The definitions of three key-terms that are “data”, “information” and “knowledge” must provide us common understandings to all fields.

For these necessities and reasons, the definitions should be as follows.

“Knowledge” is what is stored in human beings.

“Information” is some sort of flow which human beings are able to recognize.

“Data” is what is fixed on an object called some sort of media.

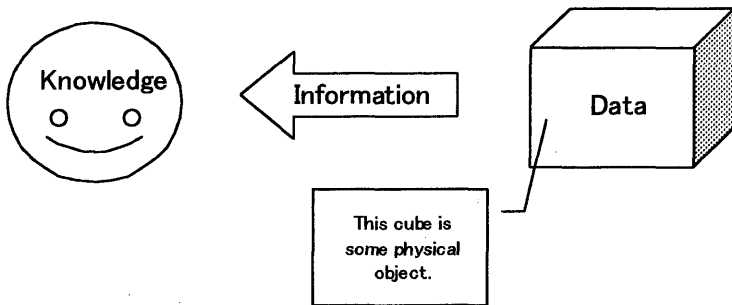


Figure 1. Relation among Data, Information and Knowledge

According to these definitions, what is stored in computer is data regardless its contents and meaning. For example, the contents of books must exist as data. When making access to computer, or, when reading books, human get information through text, sentences, figures, and pictures. And what we recognized must be information, that flow into human beings. So, if we do not activate intellectual interests or activities, it is hard to recognize information. Besides, when we succeed in storing information in our

head, it becomes knowledge. In other words, data is able to become both of information and knowledge. Additionally, what we remember is knowledge and we are able to pick out and use it and send it to anyone, when we want to inform it other people. However it would be neither information nor knowledge unless receiver recognize and understand it.

4 . Classification of Knowledge

In this chapter we are going to review of several psychology fields, and then, try to classify knowledge into several categories.

(1) What Has Been Derived From the Research of Motivations and Personality.

We are going to pay attention to several results of study for motivation and personality.

It is obvious that most of human activities are triggered by some sort of motivation. There are two categories of theories for motivation : one is based on desire and the other is based on cognitive processes. In the first one, although needs-hierarchy theory of A. H. Maslow might be the most famous one, more basic classification must be constituted with primary needs (physiological needs) and secondary needs (sociological needs), and in the latter category, there are three sub-categories : intrinsic motivation, motivations caused by casual attribution, and motivations caused by self-efficacy. Abstracts of each theory is presented in table 1.

All these motivation theories are very basic results of psychology and, of course, they must be right. And needless to say, all motivation must be generated inside human, so that they should falt into the category of knowledge, that is defined in this paper. These results clearly show that knowledge must be affected by physiological necessities, senses of values,

Table 1. Abstracts of each motivation theories

Based on Needs	Primary Needs	Primary needs brought by psychological phenomena such as feeding or hunger, breathing, regulating body temperature and so on. What is called Psychological needs.
	Secondary Needs	Secondary needs is something created by some sort of contact with others in the society. What is called Social needs such as affiliation and achievement needs.
Based on Cognitive Processes	Intrinsic Motivation	Intrinsic Motivation is something created regardless of benefits. To be concrete, epistemic curiosity or feeling of self-determination.
	Motivation caused by Causal Attribution	Human tendency to think about causes of results created by various facts concerning their activities and that must affect their following behaviors and needs. Behaviors or needs produced with this motivation must differ according to how to get causes.
	Motivation caused by Self-Efficacy	Human motivations must be influenced by not only goals but also feasibility at the beginning. When the feasibility is anticipated at high degree, self-confidence or self-efficacy would be generated and they must have much effect to do that. It is said that the relation with learning must be high.

goals or aims and personal characteristics.

Similar to the motivations, the studies or researches on personality have a very long history. From the viewpoint of the broad sense of personality, it would include temperament, character, custom, social-role and so forth. Everything considered as personality must exist in a human, therefore, all kinds of personality must be some kind of knowledge, from our viewpoint. And it is a fact that all of them must have a great influence on our activities.

Generally, in the research of KM, it would be rare that motivations or personalities are one of the important concerning factors, but are not considered knowledge, even though some of them are not inborn but acquired. In our study, it would be necessary to have a category able to include them. At least, we must have a KM system, which tolerates them.

(2) What the Cognitive Science Tells Us.

Sensory organs accept any kind of information from the outside world, and store them into a sensory memory automatically. Then, memories stored in a sensory memory must serve as a mechanism of pattern recognition. There are a lot of results of researches of pattern recognition, and one of the most basic ones must be the letter recognition, which would be adapted to information through an organ of vision. And in the case of sequence of letters, more complicated mechanism must be required to understand its abstract meanings. This mechanism must utilize something that have been recognized and retained as long-term memory before. Besides, it must be affected by other various factors such as experiences. Furthermore, if there is some sort of subtle and consistent characteristics within sequence of letters or stimuli (information), it is clear that they must affect the way of recognition. Sometimes, the same information causes different recognition according to several other factors.

In any case, what sensory organs recognize must become short-term memory. Human is conscious about short-term memories for their lifetime that is 15 to 30 seconds, but unconscious about sensory memories. And then, at last, some of short-term memories would be transferred into long-term memories.

Although capacity of short-term memories is small: it is said that it must be about seven items, capacity of long-term memories is very large and

usually regarded as being infinite. Moreover, the long-term memories must have some sort of meaning. Past researches of cognitive science have proved that the more deeply and orderly we use short-term memories for elaboration and organization, the more long-term memories we get. And there is another theory of this transformation: the more important short-term memories for a person in question, the better long-term memories. When we want to use the long-term memories, needless to say, we have to recall them. However we can not recall what we need sometimes. The reason of this failure should be caused by tentative lack of key-item or key-word to refer to. On the other hand, some of long-term memories must be disappeared : what is called forgetting.

What we get through visual perception are not only letters but also images. In the case of images, details of image would not be stored even in sensory memory, whereas the basic mechanism of transforming image memories from sensory memories into short-term and long-term memories must be same as the case of letters. Consequently images in short-term and long-term memories must be sensuous memories including much vagueness.

The contents of long-term memories are roughly classified into two groups : procedural memories and declarative memories. The contents of procedural memories are for handling or operating tools or machines. Generally it is not easy to explain the contents of this type of memory with language. A typical example must be how to make adjustments for keeping good balance for riding a bicycle. Besides, in the case of procedural memories, even though using them, we often are unconscious of using them. Furthermore, due to the difficulty to explain them with language, it must be necessary to recall them in our head intentionally, and then we have to search some suitable words to explain it from our dec-

larative memories. Therefore, needless to say, in many cases, it is hard to understand them.

The declarative memories consist of episodic memories and semantic memories. The episodic memories are about a fact of event and have contents concerning “when” and “where.” Therefore, every memories which we acquire through our observations and experiences must be episodic memories. The semantic memories do not involve anything about “when” and “where.” For example, concepts, languages, laws, theories, natural phenomena and generalized phenomena must fall into this category. If we have some key-words, it is not hard to remember contents of the declarative memories regardless of their categories. Generally, episodic memories and semantic memories must come under what is called knowledge. The table 2 shows profiles them.

Table 2. Some profiles of episodic memories and semantic memories

	Episodic memories	Semantic memories
Contents	Specific Events or Facts, which have “when” and “where.”	General things, which don't have “when” and “where.”
How to organize	Based on time series or space relations	Based on scheme or category
Source	Observations or experiences	Learning or what abstracted from repeated experiences
Feature	Subjective reality	Objective reality

(3) Classifying Knowledge

As mentioned above, what is called declarative memories in the field of psychology must be regard as knowledge. However, if we suppose that knowledge is what exist in human beings, knowledge must cover not only

declarative memories, but also motivations, personalities and procedural memories. The fact that all of them have influence on human activities, behaviors, way of thinking, etc. show us the validity of taking them into knowledge.

Our reviewing of psychology: motivation, personality and cognitive science, suggests us the following several points.

- Motivations must activate human activities.
- Motivations and/or personalities should be regarded as knowledge.
- Motivations and/or personalities must have very basic, sometimes which should be called intrinsic or inborn, sense of values, and on the other hand they must also have some acquired part.
- The cognitive science told us that procedural memories and declarative memories must be some part of knowledge.
- Although it is not easy to explain the contents of procedural memories with human language, it must be some part of knowledge.
- The declarative memories, no matter which ones we pick up : episodic memories or semantic memories must be some part of knowledge.

From the suggestions above, we should classify knowledge into four categories : a) fundamental knowledge, b) knowledge for Activity, c) knowledge for objective, and d) general knowledge. In the later part of this paper, these four categories are presented by four abbreviations, FK, AK, OK and GK, respectively.

1) FK (Fundamental Knowledge)

This is knowledge, that has great influence to the most basic sense of values, attitudes, way of thought, and some sort of belief or doctrine.

Psychological needs and intrinsic motivation must fall into this category. However, social needs, motivations caused by causal attributions, and motivations caused by self-efficacy are not always classified into this knowledge (see table 1). Regarding personalities, FK must cover temperament, character, custom, and social-role. And in the field of cognitive science, some part of semantic memories should belong to FK.

As the main feature of FK, we would be able to conclude that the contents of FK are not changeable. It is true that temperament or character is very hard to be transformed by external factors, but all of FK must not be perfectly intrinsic. Some parts of FK must be acquired, making possible to control by some proper stimuli or information from others.

Incidentally, some of FK must be formed by non-linguistic information : some images or pictures or scenes, which provide us criteria of sense of beauty, and some smells or feels, which give us criteria of sense of comfort. Even though what we accept is non-linguistic information, if beautiful, human must get such feeling, so that FK must have some non-linguistic part as some sort of criteria. Consequently, FK must consist of both linguistic parts and non-linguistic parts.

2) AK (Knowledge for Activity)

AK must control both of abilities of physical activities and intellectual activities. AK must be equal to procedural memories in the cognitive science. Most human hold very usual and basic abilities of activities, such as walking, running, speaking, listening, eating, moving hands and so on. However, with just only them it is hard to satisfy requirements from our society or belonging organization. To meet various and relatively high-level requirements, it is necessary to do learning, studying,

or practical training.

Activities cover a wide range : from easy to difficult ones. In the case of the easy activities, it would be possible to express how to get the ability and how to improve it with natural language. However, in the case of the difficult ones, it is almost impossible to make clear explanation with linguistic methods. Skills of specialists, that took long time to be obtained, must be the typical example of difficult activities. Therefore, as same as FK, AK must have not only linguistic parts, but also non-linguistic parts. Indeed, very special sense of feel, that only special people usually called "expert" or "master" can recognize, must be one of non-linguistic AK.

3) OK (Knowledge for objective)

Although doing very various activities, human beings must have their own objectives for each case. Some of them must be psychological objectives, so that the person in question might not recognize them as objectives. However, there must be objectives with every human activity. This is what is called OK in this paper. OK must be trigger for activities and must be necessary to do anything. Incidentally, most of OK must be expressible with natural language.

4) GK (General Knowledge)

GK is all other knowledge, which does not fall into three sub-categories mentioned above. In short, GK covers from knowledge memorized by learning to knowledge gotten with some experiences. And of course there are non-linguistic ones.

5. Relations between Intellectual Activities and Knowledge

Intellectual activities must be everyday experiences for us. When we have some problems, purposes or needs, we would receive and get information and knowledge, and then utilize them to create solutions such as new ideas through thinking. And at last, in many cases, we are going to inform them to others. In such everyday experiences, various intellectual activities must be required. Incidentally, as mentioned in the prior chapter, if we follow the classification of knowledge, AK must control these activities.

Some concrete examples of intellectual activities are recognition of accepted information, memorizing (transformation short-term memory to long-term memory), recalling (picking up the necessary items from long-term memories), thinking to make decisions or to solve problems, making presentation to inform some knowledge stored in oneself to others, and so forth. The cognitive science has already proved that it must be performed simultaneously (to be precise, not simultaneously but sequentially during a very short time).

Needless to say, in our intellectual activities much obtained knowledge then is abstracted and used very often. From a viewpoint of reusing knowledge, if necessary, the contents of FK must be served into intellectual activities in an instant without our consciousness. And we must be also able to use AK in any case of necessity instantly and involuntarily. Concerning OK, situations must be a little different. Thinking twice about OK, its contents must be distinguished into two groups : first, one that contains relatively permanent objectives, in short, long-cherished objectives, and the other one, that contains temporal objectives. Some of the permanent objectives might become FK, because of the high level and long period intensity to achieve them. Even though transformation from OK to FK has not

occurred yet, in the case of permanent objectives, they must be appeared instantly and involuntarily. On the other hand, in the cases of temporal objectives, if there is no necessity, they must not exist as OK. When some necessity comes up, some of GK would become temporal OK. So that now, we have to think about GK, that contains any knowledge that is not distinguished into other three categories : FK, AK and OK. Retrieval on GK must be sometimes not easy. If there are no good key-words or key-items, it should fail to pick up proper knowledge. That is failure of retrieval from long-term memories.

We are going to continue to think about GK a little more. Let's think about knowledge of language. Knowledge of language must fall into GK, and failing to recall words frequently used in our everyday life, must be rare. Generally, we are able to recall what we use frequently, not only knowledge of language or words, but also knowledge of theories, methods, rules and so forth. And even though not used frequently, we should be able to recall knowledge that is well structured and deeply understood. In short, although what we want to recall is placed in GK, if it is frequently

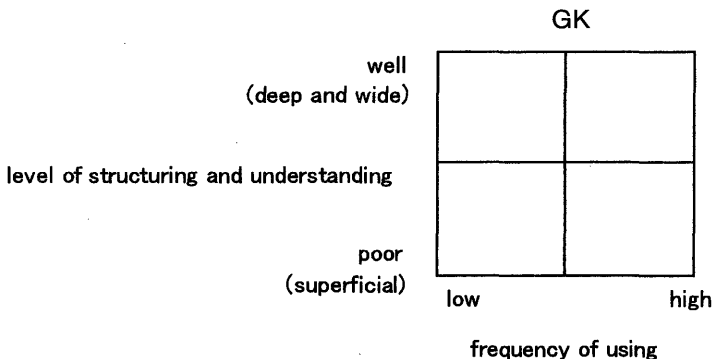


Figure 2. Two criteria of GK

used or well-structured and deeply understood, picking up from GK must be easier. Therefore, GK must be represent with two criteria : first frequency of using ; second, degree of structuring and understanding. (See figure 2)

The criterion of level of structuring and understanding must correspond to a term “scheme” in psychology. In psychology, scheme is a concept and a module in which knowledge must be constituted. In our research, this thought must be suitable, and needless to say, non-linguistic knowledge, such as memories of images and smells, must be component or element of knowledge and must have relations with other components or elements of knowledge, which might be both linguistic and non-linguistic knowledge. And if there are some relations among several components of knowledge, some sort of structuring is performed.

The knowledge, which is used frequently and well structured, must be served to any of our intellectual activities in case of necessity instantly and involuntarily. The knowledge that is used frequently must be useful for the person in question, so that the sense of values for that knowledge must be increased gradually, and at last, that knowledge must be transformed into FK. Furthermore, in the case that non-linguistic knowledge of GK is used frequently for not only intellectual activities but also physical activities, such non-linguistic knowledge would be changed in quality little by little, and finally, it must become some sort of AK. The psychology has already proved that repeating recognition must provide us good effects or improvements, (that is called “rehearsal.”) We are going to call these transformations “Maturity of Knowledge.” (See figure 3)

Maturity of knowledge must improve our ability of intellectual activities effectively, this is, understanding knowledge elements of GK deeply or making wide-structure among them and using them frequently must be very important key requirements in KM.

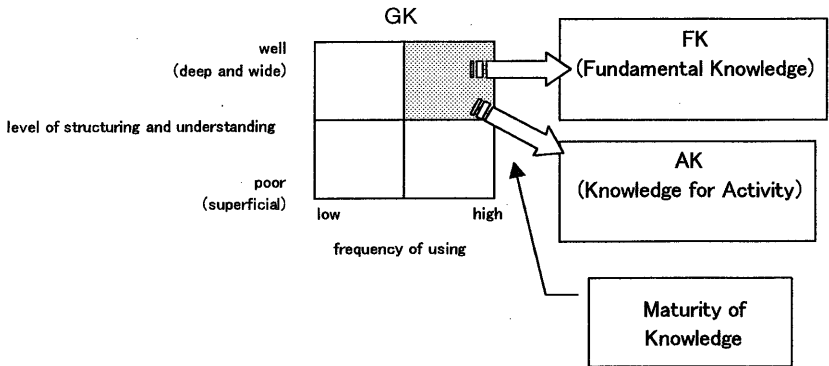


Figure 3. Maturity of Knowledge

The figure 4 shows relations between knowledge existed in human and intellectual activities, and also shows usual process of intellectual activity, which is constituted five phases, as follows.

First, when recognizing a problem or a need, we would set objectives. Sometimes OK has existed as OK originally. In this case, some stimuli or triggers must activate dormant objective. And in the other case, objectives must be derived from GK or FK, and it must be set as OK.

Second, OK would ignite some AK to do activities. The sort of ignited activities must depend the on nature of objectives.

When intellectual activities are activated like the figure 4, third phase starts ; intellectual activities would be performed and all knowledge has possibility to be served into that activities. Usually, intellectual activity would cover accepting information from the outside world and understanding them, thinking or searching some solution for problem or objectives, remembering them, and sometimes expressing them to others.

Fourth, new knowledge gained or created by intellectual activity would be stored as GK.

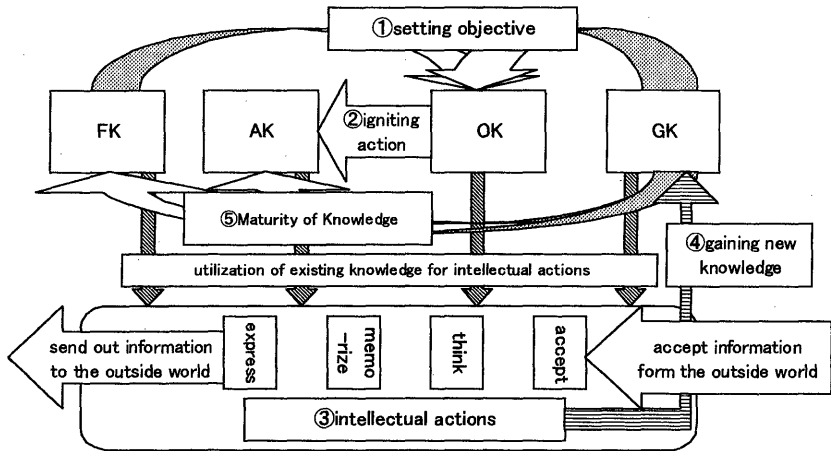


Figure 4. Relations between Knowledge and Intellectual Activities

And after repeating this process of four phases many times, as fifth phase, transformation GK to FK and GK to AK must take place ; that is what we called Maturity of Knowledge.

6 . Implication of This Research And What We Have To Do Next.

The summary of this research is as follows ;

- Definitions provide us clear distinction between the most basic three key-words ; data, information and knowledge.
 - Data is what is fixed on an object called usually some sort of media.
 - Information is some sort of flow that human is able to recognize.
 - Knowledge is something invisible and intellectual stored in human beings.
- Based on our definition of knowledge, Using wisdom out of fields of

psychology, knowledge must be classified into four sub-categories : FK (Fundamental Knowledge), AK (Knowledge for Activity), OK (Knowledge for Objective) and GK (General Knowledge).

- FK is the most basic and essential knowledge existed in human beings, in other words, FK has big influence to the most basic sense of values, attitudes, and so forth.
 - AK is knowledge, that controls all of human activities including not only intellectual activities but also physical activities.
 - OK is every objective for any activities.
 - GK is all other the knowledge, that does not fall into the three sub-categories mentioned above.
- Through considering the relation between knowledge classified into four sub-categories (FK, AK, OK and GK) and intellectual activities, we derive two important criteria for GK : level of structuring and understanding and frequency of using.
- In other words, understanding knowledge elements of GK deeply or making a well-structure among them and using them frequently must be very effective to improve our intellectual activities, and these must bring about transformations from GK into FK or AK, that is what we call Maturity of Knowledge.

The result of this research might raise strange feelings, especially definitions for data, information and knowledge must be unique and it is impossible to follow these definitions in our everyday conversation. However, from the viewpoint of research, making a clear distinction between them must be necessary.

Furthermore, our classification of knowledge must be unique, too. Although, what we derived by considering our four sub-categories is based

on consideration of individual person, this research considers that it would be effective on organizations or companies. If we are able to follow this hypothesis, what we derived must not be strange and other scholars have advocated similar things. For example, P. M. Senge who is the author of "The Fifth Discipline", said that five disciplines : "System Thinking", "Personal Mastery", "Mental Model", "Building Shared Vision" and "Team Learning", must be necessary for making learning organization. Among his five disciplines, System Thinking and Personal Mastery must be equivalent for pre-condition and necessity of our Maturity of Knowledge, respectively⁴⁾. In addition to that, like Senge proposed the importance of understanding "Mental Model", it is necessary to pay attention to human factors in the future research for KM. In the case of our research, especially FK and AK among our four categories of knowledge would be able to include various human factors as knowledge.

Consequently, our basic frame for KM would have possibility to make much progress. Incidentally, difference of our research from "Fifth Discipline" of P. M. Senge is that his approach is based on processes or procedures, not knowledge.

Though our resource is based on knowledge, most of our findings of this paper must be some sort of frame of statistic system. So that, even though the four sub-categories of knowledge are a suitable frame for KM research, it is obvious that they would not provide us pragmatic benefits by themselves. Needless to say, various detailed procedures or processes must be required and developed. Furthermore, it is of course necessary to make deep investigation about not only human factors, but also company factors, such as "Building Shared Vision" and "Team Learning" proposed by Senge.

To achieve that, it would be necessary to make many careful surveys and investigation of KM and concerning fields, and compile their essences

into our final result. We would be able to make verification and modification of our frame. As mentioned above, our frame must be unique and still rough, however we have not excluded anything. Therefore, it must be acceptable to any righteous theories.

Another thing to do is consider case studies. Through studying real facts and phenomena of many real organizations, we have to make up our frame into a pragmatic one.

- 1) For example, computer science, communication technology, software engineering, management theory, organization theory, and so forth.
- 2) Michael J. Earl, 『Knowledge as Strategy: Reflections on Skandia International and Shorko Films』, 1994
- 3) Laurence Prusak, 『Knowledge in Organizations』 Butterworth-Heinemann, 1997, pp. xiv-xv
- 4) Peter M. Senge, 『The fifth discipline : the art of practice of the learning organization』, Currency Doubleday, 1990