

The Shift in the Definition of “Knowledge”

There have been studies on knowledge in a variety of disciplines, such as engineering, management and psychology. The domain of the term “knowledge” has seen a considerable change and expansion, even if we look only at recent years. We will delineate the transition of “knowledge” in each discipline and seek a comprehensive definition of “knowledge” for this book.

1.1 The Range of “Knowledge”

1) *The range of “knowledge” in engineering*

The field of engineering that deals with the systematization of knowledge is called knowledge engineering, which originated with the Heuristic Programming Project (HPP) at Stanford University in 1965. The HPP succeeded in completing an expert system to deduce the structural formulas of organic compounds: DENDRAL. This opened up the possibility of computer systems solving problems in place of human experts, by transplanting expert knowledge onto computers. Since then, researchers vigorously constructed various expert systems, such as MYCIN.¹ These systems, however, could only manage knowledge that could be stated in the “rule” formula — if A, then B — which limited their problem-solving ability. Nonetheless,

¹MYCIN is a medical expert system, which gives advice on treatment for blood infections and meningitis. It was developed at Stanford University in 1972.

this triggered the study of knowledge engineering, since in building expert systems, the idea was promoted that the representation of knowledge should be approached as an object of scientific study, rather than as a series of randomly derived rules.

The objectives of knowledge engineering are to grasp knowledge systematically and to utilize it effectively. The main task is to codify knowledge in a form that can be integrated into computer systems. In other words, the “knowledge” in knowledge engineering is “that which can be stored and sorted in a way that can be readily accessed when needed”.²

2) *The range of “knowledge” in psychology*

What “knowledge” means in psychology varies greatly, depending on which branch you turn to.

In behavioral psychology, knowledge is considered to be a mass of “stimuli–response” relationships, since its main focus is on analyzing the rules of those relationships. Pavlov’s well-known experiments in conditioned reflexes are the prime examples of this school.³

The information processing approach in cognitive psychology conceives human intellect as an information processing system, and it aims to comprehend mental processes by identifying this system. This approach classifies memory into three categories, according to the duration of memory retention: sensory memory, short-term memory and long-term memory. Knowledge is defined as what is stored in the long-term memory. This school of thought, however, began to decline in the late 1970s, as it became obvious that it was too simple to fully elucidate the mechanism of human cognition.

²The original quote is from Information Processing Society of Japan (Ed.), *Knowledge Engineering*, Ohmsha, 1987, p. 4.

³Ivan Petrovich Pavlov (1849–1936) was a Russian physiologist, psychologist and physician. While measuring dogs’ saliva in his experiments, Pavlov discovered the phenomenon of “conditioned responses”.

The Piagetian school in the theory of cognitive development defines that knowledge is actively constructed.⁴ It assumes that men have cognitive structures, and that knowledge is constructed through adaptations of cognitive structures to the environment.⁵

3) *The range of “knowledge” in management theories*

Mottoes such as “knowledge is a competitive asset” or “how you manage knowledge decides corporate competitiveness” have long been heard in the business world. It can safely be said that the term “knowledge management” has entered the lexicon of management studies. However, yet again, what “knowledge” means here is not a simple matter.

The management guru, Peter F. Drucker, explains the shift in the definition of the word “knowledge”. He says that knowledge, which used to apply to “being”, came to be applied to “doing”, such as “tools, processes and products”, and ultimately to “knowledge” itself.⁶ That is, the nature of knowledge changed from the abstract and existential (e.g., “why the world exists”) to the concrete and practical (e.g., “how to produce plastic”).

Ikujiro Nonaka, a specialist on corporate creativity, refers to two types of knowledge: explicit and tacit knowledge.⁷ Explicit knowledge can be transmitted between individuals systematically or formally, whereas tacit knowledge is difficult to formalize or share with others as it is personal and circumstantial.⁸ This notion of “tacit knowledge” was groundbreaking, as it broadened the concept of

⁴Jean Piaget (1896–1980) was a Swiss philosopher and psychologist. He developed new fields of science, namely developmental psychology and genetic epistemology.

⁵Cognitive structures are mental schemes that help us make sense of the environment, and they determine our behavior and responses.

⁶The original text that the author refers to here is Drucker, P. F., *Post-Capitalist Society*, Collins, 1994.

⁷Nonaka, Ikujiro and Hirotaka Takeuchi, *The Knowledge-Creating Company*, Toyo Keizai, 1996.

⁸Examples of explicit knowledge are data, scientific formulas and manuals. Examples of tacit knowledge include craft skills, personal beliefs and values.

“knowledge” from codified information to include even inarticulate mental muddle. Nonaka believes that new knowledge is created through social interactions of the two kinds of knowledge.

In recent years, many management consulting firms have started to introduce “knowledge management” as one of their business strategies. What knowledge management refers to is quite extensive though — it varies from the construction and management of a knowledge base as seen in knowledge engineering, to that of a “platform” for information as an auxiliary knowledge creation tool.

In addition to formally or systematically codified knowledge, some consultants include in knowledge those intangible concepts, such as brand names that evoke certain feelings among consumers, or even a specific atmosphere created among a group of people (see Table 1).

Thus, the domain of “knowledge” differs according to disciplines, and it has been expanding in each discipline as the study has progressed, generally from what can be systematically and logically studied to what is difficult to articulate, such as “atmosphere”.

Table 1: Examples of Knowledge as Property

	Empirical Knowledge	Formalized Knowledge	Institutional Knowledge
Market Knowledge	<ul style="list-style-type: none"> ◇ Knowledge of consumers, learned from experience with products and services ◇ Knowledge of distribution networks, learned from experience with products and services 	<ul style="list-style-type: none"> ◇ Assessment of brand equity corporations 	<ul style="list-style-type: none"> ◇ Knowledge gained from networking and communicating with customers (e.g., consumer monitoring) ◇ Knowledge concerning market and customers, gained from distribution networks

Table 1: (Continued)

	Empirical Knowledge	Formalized Knowledge	Institutional Knowledge
Organizational Knowledge	<ul style="list-style-type: none"> ◇ Knowledge and abilities that employees have obtained ◇ Core knowledge and abilities of specific professions 	<ul style="list-style-type: none"> ◇ Knowledge and abilities concerning development, planning, design of products ◇ Quality perception 	<ul style="list-style-type: none"> ◇ Systems for organizational training (educational programs and training know-how) ◇ Knowledge circulated in an organization via communication systems (e.g., contents of e-mail)
Product-Based Knowledge	<ul style="list-style-type: none"> ◇ Know-how for products and services that can be shared ◇ Traditional skilled knowledge, such as methods of manufacturing 	<ul style="list-style-type: none"> ◇ Product concepts (quality and quantity of concepts of products both in the market and in development) ◇ Product design, including models and prototypes 	<ul style="list-style-type: none"> ◇ Complementary and specific knowledge of products, such as how to use products (partly formalized by manuals) ◇ Social and legal knowledge application system of products (environmental issues, product liability)

Source: Konno, Noboru, *Management of Intellectual Property*, Nihon Keizai Shimbun, 1998.

1.2 The Basic Nature of “Knowledge”

It is only natural that “knowledge” studied in various disciplines has different meanings, as different fields of study have different objectives. However, there is one characteristic of knowledge that is common to all. That is, knowledge is valuable only when there are



Figure 1: Historic Sanctuary of Machu Picchu (Inca Civilization)

people to appreciate it. However advanced a technology is, it dies with the individual who owns the knowledge, unless it is communicated to another.

The Maya and Inca people of Central America left proof of their highly advanced civilizations in the ruins of their ancient cities (see Figure 1). Yet it is impossible for us to decipher their civilizations minutely, as the records of their culture, including their technologies and philosophies, are mostly lost.

Hence, we define “knowledge” in this book as “that which is lost unless deliberately maintained”, including tacit knowledge such as craftsmanship. This means that besides what we have seen above, “knowledge” includes folklore, music and cultural tendencies. We call it knowledge if it is given a name and can be passed on to others.