Systems Intelligence in Knowledge Management Implementation: A Momentum of the SECI Model

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Keywords: systems intelligence, systems thinking, system of holding back, knowledge management, the SECI model

Abstract. This paper discusses the role of systems intelligence in knowledge management implementations, in particular, in the SECI model, a widely acknowledged knowledge creation process in an organization identified by Nonaka and Takeuchi (1995). The SECI model deals with interactions and conversions of tacit knowledge and explicit knowledge and mainly consists of four stages. The author illustrates systems intelligence, a certain kind of human intelligence focusing on systems thinking perspective proposed by Saarinen and Hämäläinen (2004), can be a powerful momentum at each stage of, and thus the whole process of, SECI.

Introduction

Since 1990s, management thinkers have argued knowledge is the most important resource for an organization's (typically a firm's) sustainable success (e.g. Toffler, 1990; Drucker, 1993), and importance of knowledge management has been widely recognized in order to create and utilize the resource in an organization. Knowledge management is not limited to learning best practices of other companies but rather continuous knowledge creation inside the organization is considered as essential. The SECI model proposed by Nonaka and Takeuchi (1995) is probably the most well-known model of organizational knowledge creation. It deals with interactions and conversions between tacit knowledge and explicit knowledge and consists of four stages: (S)ocialization, (E)xternalization, (C)ombination, and (I)nternalization.

Since then many organizations have acknowledged the importance of knowledge management based on the SECI model and tried to incorporate its idea in their management processes. However, a number of firms have failed to incorporate and manage the process properly, and, in short, the cause of the failure in most cases derives from considering knowledge and information as synonymous (Nonaka and Konno, 1999; Malhotra, 2004). A typical example is that "knowledge management" ends up with just introducing an information system which can accumulate and share best practices inside or outside the firm or documented information. This is based on "the engineering paradigm" (Malhotra, 2004) and deals only with existing knowledge. In contrast, according to Nonaka and his colleagues, the knowledge creation process combining tacit and explicit knowledge is essential and thus human factor cannot be discounted. Furthermore, how to utilize such an information system can also highly depend on human aspects. Prior to its introduction, it is very important to design how to involve knowledge workers in the system, changing their minds to fully exploit the potential of the system recognizing the philosophy of the SECI model (Nonaka and Konno, 1999). In fact, it is often the case that even if such an information system (e.g. groupware, knowledge database) is introduced once, it is not used as effectively as the manager expected because the introduction itself is not sufficient to motivate the users (Hendricks, 1999; Tsai et al., 2010). In addition, not surprisingly, it has also been pointed out that the applicability of the SECI model may highly depend on the cultural context of the organization or the nation (Glisby and Holden, 2003; Andreeva and Ikhilchik, 2011).

This paper's as well as Nonaka's emphasis is on the fact that the human factor, such as subjectivity, sensitivity, emotion, passion, is the key. It seems that while its importance is emphasized very much in the knowledge management literature, there is a lack of discussion on how in practice we can touch minds of the stakeholders and change their micro-behaviors. Here I consider the discourse of systems intelligence (Saarinen and Hämäläinen, 2004) can provide a useful perspective to complement the lack because this problem is exactly the primary issue of it. Systems intelligence is a certain kind of intelligence combined with the systems thinking perspective. In this paper I will illustrate how systems intelligence can be a powerful momentum at each stage of, and thus the whole process of, SECI.

Thus the theoretical contribution is to combine the two initiatives, the SECI model which has been widely acknowledged in the knowledge management community and the notion of systems intelligence which has been recently developed in the field of systems science. Systems intelligence has been studied in a wide range of applications including management issues such as leadership (Hämäläinen and Saarinen, 2006), but this paper is the first to discuss it in the context of knowledge management.

In the rest of this paper, following this introduction, we first overview the concept of systems intelligence and the process of SECI model respectively, and then discuss how systems intelligence can work effectively in SECI.

Systems Intelligence

In its original definition, systems intelligence is "an intelligent behavior in the context of complex systems involving interaction and feedback" (Hämäläinen and Saarinen, 2006). An intelligent agent in this sense "experiences herself as part of a whole, the influence of the whole upon herself as well as her own influence upon the whole" (ibid.). It is a certain kind of intelligence (e.g. Goleman, 1995, 2006) combined with the systems thinking perspective (e.g. Jackson, 2003). In other words, it combines

Saarinen and Hämäläinen have argued that, in the context of organizational learning, systems thinking has been proven to be a powerful tool to solve a specific complex problem, but its link to sustainable learning and success of an organization is missing. Indeed Senge's updated edition of *The Fifth Discipline* (1990/2006) acknowledges that building leaning organization has turned out to be significantly more difficult than what he envisioned in 1990, when its first edition was published. Then their focus moves from "thinking" with a theoretician's expertise of systems thinking to "actions" backed with a certain kind of intelligence – intelligence with systems perspective, i.e. the fact that people inside the system are interconnected, they act according to each mental model about the system, and the systems has a feedback loop.

Unlike systems thinking, systems intelligence does not require one to identify how people are interconnected or what kind of feedback loops there exist. Rather it is the key question of systems intelligence studies what intelligent choice can mean when one cannot step outside the system and sort out the options and their systemic impacts. Systems intelligence is not unveiling the structure of the system and not an optimization tool but something that aims to touch one's mode of thinking and thus change every day micro-behavior. Then it is important to admit the possibility that change in a micro-behavior can work as a "systemic leverage," where a minimal input can generate a huge output. Here the underlying assumption is that the core beliefs of people may not show up in their behaviors and thus one has to act on her mental model about the system, i.e. what she believes is the system. If someone observes another person's change in behavior, it may lead to change in her mental model and thus her behavior. When a chain of this kind of change happens, the first change in someone's micro-behavior can change largely the output of the system. Systems intelligence's optimism for change is explained in this way. Therefore it emphasizes human perspective such as sensitivity in the systems context. Saarinen and Hämäläinen (2004) describe the process as four dimensions: mental change, perceptual change, individual behavioral change, and change in the system. This mechanism is also studied in terms of mathematical decision theory (Sasaki and Kijima, 2010; Sasaki et al., 2014). Particularly, since interactions of multiple persons are the basis of a system, it can be described in game theoretical terms. Also it has been applied to the behavioral aspects of operations research (Hämäläinen et al., 2013).

Another important characteristic of systems intelligence is that it is not expertise but something human beings possess inherently. Therefore it is not learning some new methodology but just an awareness for one to become systems intelligent. Rather it is often a preconscious action to back it up. In fact Saarinen and Hämäläinen say, in their lectures and seminars, many non-academic people can easily understand its essence and feel encouraged to act intelligently. Thus it is a very practical perspective, and this is why I consider it can be applicable to knowledge management implementation which involves a number of members of an organization.

The SECI Model: The Process of Organizational Knowledge Creation

Next, the SECI model is a widely acknowledged organizational knowledge creation process proposed by Nonaka and Takeuchi (1995). It deals with interactions and conversions of tacit knowledge and explicit knowledge, and consists of four stages (Fig. 1). They inductively derived this model based on companies showing superior performances, thus it is a descriptive model of good practices, and at the same time, it can be regarded as a prescriptive model for other companies that are about to do or doing knowledge management.

Each of the four stages can be summarized as follows. First, socialization is the transfer of tacit knowledge, that is, the tacit acquisition of tacit knowledge by people who do not have it from people who do. Thus this happens basically in face-to-face interactions among individuals. Second, externalization is the conversion of tacit knowledge into explicit knowledge. Typically this is done by documentation or verbalization. The converted knowledge can be shared with members of a group. Third, combination is generating new explicit knowledge from existing one. This happens through sharing, transfer or integration of explicit knowledge among groups. This process can be managed in an organizational level. Fourth, internalization is embodying explicit knowledge into tacit knowledge. This is close to "learning by doing" (ibid.). Thus it is a process of adopting explicit knowledge shared in a group or an organization as an individual's original tacit knowledge.

The SECI process is not just one "circle" but a "spiral", that is, a never-ending dynamic process. The internalized tacit knowledge can be then socialized, and the knowledge interaction process goes on. This means

that, after several rounds of the spiral, an individual as well as the organization have new knowledge that had not been possessed at first. Thus the SECI model is also referred to as the model of a self-transcending process, and this is considered as the essence of organizational knowledge creation.

As stated in the introduction, an information system is often introduced in knowledge management in the form of groupware, knowledge database, and so on. This is typically utilized in the stage of combination as such a system can basically only treat explicit knowledge, i.e. documents, graphics, numerical data etc., and also can support the process of externalization to some extent. It also can be said that the firms that fail to implement knowledge management in a proper way have neglected the other stages of the SECI model (Nonaka and Konno, 1999).

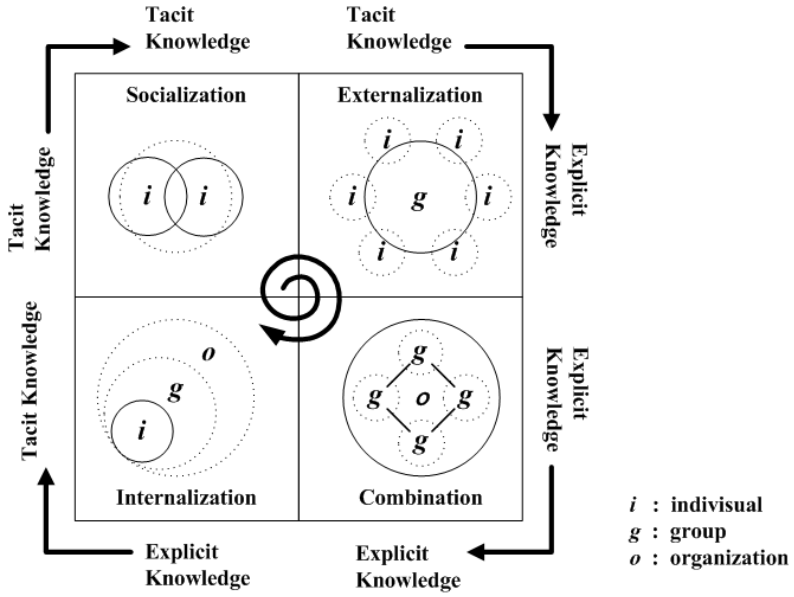

Fig. 1: The SECI Model
(Nonaka and Konno (1998), p.43)

Organization as a Knowledge Creation System via the SECI Model

Then let us move to the main topic of this paper, how systems intelligence can work in and promote the process of the SECI model.

First let us "translate" the SECI model into the system terms. That is, let us see an organization as a knowledge creating system via the SECI process which consists of four subsystems: socialization, externalization, combination and internalization. Each subsystem can be seen as an input-output system, and is interconnected with each other in the form that a subsystem's output will be used as the next subsystem's input (Fig.2).

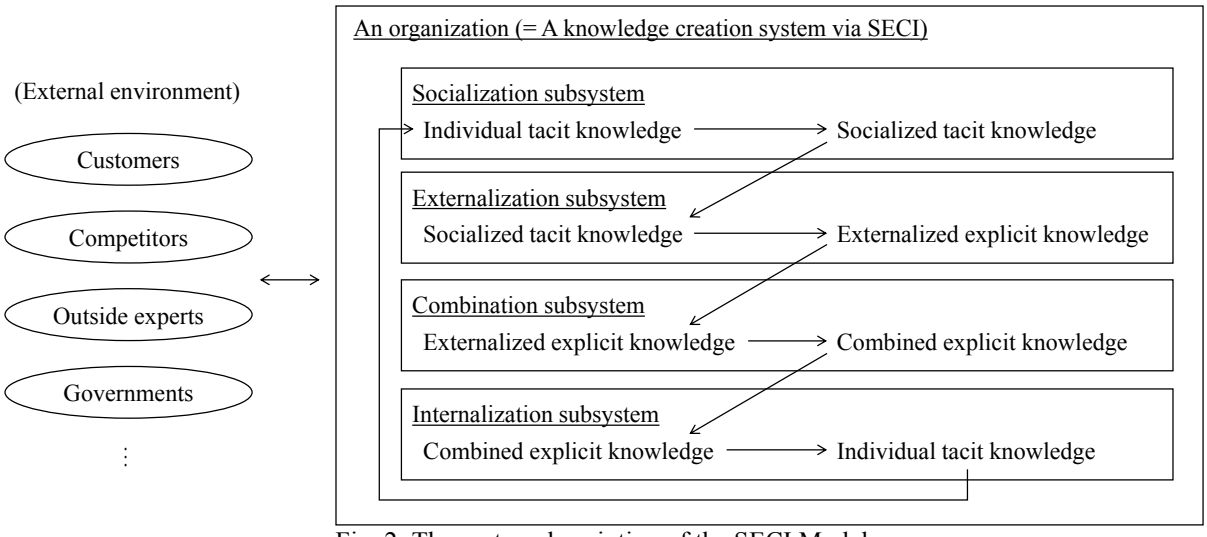

Fig. 2: The system description of the SECI Model

Note that this system should be considered not as a closed system but as an open system which has interactions with the external environment such as customers, competitors, outside experts and governments, based on Nonaka's argument. Furthermore, given that the SECI model is a self-transcending process as mentioned above, it necessarily possesses the fundamental nature of a system: the whole is more than the sum of the parts.

The Role of Systems Intelligence in the Organizational Knowledge Creation System

In this organizational knowledge creation system, each subsystem is not a pure engineering or mechanical system but a human interactive system as Nonaka and his colleagues emphasized. Of course its efficiency can be supported to a large extent by informational systems etc., but we can never discount importance of human factors.

Let us see how they are important in each subsystem based on discussions in Nonaka and Takeuchi (1995). First, as it is the basic form of the socialization subsystem that individuals interact with each other spontaneously, it is clear that individual subjective views, or mental models, can have critical roles. Therefore if a member of the system is closed psychologically, reserved or feels fear about sharing experiences, the subsystem does not function well. Interactions with the external environment, namely customers, competitors etc., are also important for one to acquire new tacit knowledge. Second, in the externalization subsystem, the key is also interactions between individuals or between an individual and a group. Thus it is important to stimulate a member in a positive way so that he/she feels like expressing his/her tacit knowledge, information, feelings and so on, which will become the outputs of the subsystem. Third, in the combination subsystem, an IT system can play a big role as mentioned above. However how it can be used by the members depends very much on the organizational cultural context. It is important not only to exchange information and documents but also to share the context behind them. For example, a mere exchange or accumulation of information yields a huge amount of information that we have no idea to use. We want not useless information but knowledge valuable for our decisions. Here the importance of communications and sharing contexts, culture, and language can be noted. Furthermore even a technologically excellent IT system becomes valueless if used by only few people. It is also important to motivate them to use it in a proper way (Hendricks, 1999; Tsai et al., 2010). Finally, in the internalization subsystem, the main process is an individual's practice, trial, simulation, or experimentation of the combined explicit knowledge. Thus his/her will to do so is the key drive here. The explicit knowledge is supposed to be converted as new tacit knowledge through these kinds of individual processes. Then such new tacit knowledge, the output of the internalization subsystem, can be used again as the input of the socialization subsystem. When the interconnection of the four subsystems works well and the spiral process goes on continuously, the whole system (the organization) acquires the sustainable ability that enables it to continue to produce valuable knowledge.

Hence all the subsystems are human interactive systems which are targeted by the discourse of systems intelligence. According to the underlying assumption of it, in each subsystem, people make decisions and act based on their images about other people and the organization, and about their influence of themselves on the organization. Here is optimism for change, that is, even a micro-behavioral change triggered by systems intelligence can produce change in the subsystem, and thus change in the total system.

This can be explained with the five dimensions of changes induced by systems intelligence obtained by modifying the original four dimensions (Saarinen and Hämäläinen, 2004), which is described in Table 1. The first four steps can happen in each subsystem ((1) to (4)) and those changes in the subsystems can bring about change in the total system, i.e. the organization (5).

Table 1: The five dimensions of changes in the organizational knowledge creation system

(1) Mental change	One accepts the systems intelligence perspective.
(2) Perceptual change	One sees himself/herself as a part of the whole system, and admits the possibility that his/her original mental model might not have captured the true structure of the system.
(3) Individual behavioral change	One changes the mode of thinking relevant to his/her every day micro-behavior, and tries new actions which have not taken previously.
(4) Change in the subsystem	Triggered by someone's micro-behavioral change, through the feedback loops possessed by the system, the subsystem can produce richer and more valuable outputs than before.
(5) Change in the whole system	The whole system can produce more effective organizational knowledge creation than before.

For example, Nonaka and Takeuchi (1995) give some concrete examples of a socialization process such as face-to-face communications with external stakeholders, the manager's walking around in the workplace, and sharing experiences among workers. All of these can be enhanced by systems intelligence. A systems intelligent

manager not only just walks around and observes the office but also may be able to open the new door of conversations with his/her subordinates and touch their feelings so that they share their tacit knowledge openly. A systems intelligent worker also can try to have new types of opportunities in interactions with his/her customers, colleagues etc. so that he/she can obtain new knowledge from or give his/her own knowledge to others. Consequently they can enrich the output of the socialization subsystem, namely socialized tacit knowledge.

Similarly, systems intelligence can enrich the outputs of the other subsystems, externalization, combination and internalization, as well. Through the interconnectivity of each subsystem, the output of the whole system, organizational knowledge creation, can be enhanced more than before.

If the current knowledge management process fails due to such human factors, it falls into what Hämäläinen and Saarinen (2006) call a "system of holding back." It is such a system in which people have a common desire but somehow it never appears and instead a less desirable outcome occurs. A typical example in a firm is described in an article written by Ackoff (2006). When he gave lectures on systems thinking to workers in a company, they said after the lectures, "This is great, I would love to use it, but I can't introduce it without approval of my boss." Then he gave a lecture to the CEO of the company, and the CEO said, "This is great, I would love to use it, but I can't introduce it without support of my subordinates." Then the company did not adopt systems thinking. Both the CEO and the workers hold back their actions to use systems thinking despite the fact that both of them want to use it. The same goes for the failed knowledge management process. Even if everyone admits the importance of knowledge management and excellence of the IT system introduced for the purpose, if they hold back their contributions to them, the organizational knowledge creation system can fall into a system of holding back. In general, a system of holding back is the main target of systems intelligence, and its primary goal is to get over the trap and make the systems produce better outcomes.

As mentioned above, systems intelligence is considered as an inherent intelligence. All what one needs to become systems intelligent is just awareness, or it may be even a preconscious action to back it up. Therefore I consider the discussion above can provide a simple and practical perspective for the sustainable betterment of an organizational knowledge creation system. The "sustainability" is the key here. If a manager tries to use systems thinking to tackle with the failure of knowledge management, according to the Senge's description and discussions raised by Saarinen and Hämäläinen, it may be useful to solve the specific problem but hard to lead to the sustainable improvement. On the other hand, the systems intelligence approach touches daily micro-behaviors of people and seeks for the possibility of change in the system triggered by them.

Conclusion

This paper has discussed the role of systems intelligence in knowledge management implementation, in particular, in the context of the SECI model. Of course, given that most failures in knowledge management are caused by the fact that the idea and philosophy of the SECI model are not incorporated properly in such organizations (Nonaka and Konno, 1999), it would be the first important thing that both the manager and workers understand them. But as the next step, since the applicability of the SECI model highly depends on the human and cultural contexts as Nonaka emphasized, systems intelligence can work as a momentum of the SECI process and be useful to avoid the knowledge creation system's getting stagnant as a system of holding back. The theoretical contribution of this paper is to combine the two useful perspectives developed in different communities, the SECI model and systems intelligence.

The complex problem of a system of holding back is that it is hard for people inside the system to notice the current system is a system of holding back. This is because they often think they are doing the best they can and at least do not think, "This is a mistake." (Remember the example of the CEO and his subordinates.) With regard to this, Ackoff (2006) noted there are in general two types of mistakes: "errors of commission" and "errors of omission." The former refers to such a situation that an individual, or an organization, does something that should not have been done. On the other hand, the latter refers to such a situation that someone fails to do something that should have been done. Of the two types of errors, Ackoff says, errors of omission are usually more important. When we commit an error of commission, we can notice the fact and learn lessons from the mistake. But it is very difficult or even impossible when we commit an error of omission: we cannot notice the fact that we have mistaken in this case. If a knowledge management process gets stagnant due to holding back, it can be seen as an error of omission in the sense that the organization, or its member, fails to do something to produce an effective knowledge creation process. Here is a room for improvement of the system driven by systems intelligence.

As a future research program in this line, obtaining empirical data to support the discussion above would be important.

References

Ackoff, R. L. (2006), "Why few organizations adopt systems thinking." *Systems Research and Behavioral Science*, 23(5), 705-708.

Andreeva, T. and Ikhilchik, I. (2011), "Applicability of the SECI model of knowledge creation in Russian cultural context: theoretical analysis." *Knowledge and Process Management*, 18(1), 56-66.
Drucker, P. (1993), *Post-Capitalist Society*. Butterworth Heinemann, London.
Glisby, M. and Holden, N. (2003), "Contextual constraints in knowledge management theory: the cultural embeddedness of Nonaka's knowledge-creating company," *Knowledge and Process Management*, 10(1), 29-36.
Goleman, D. (1995), *Emotional Intelligence*. Bantam Books, New York.
Goleman, D. (2006), *Social Intelligence*. Bantam Books, New York.
Hämäläinen, R. P., Luoma, J. and Saarinen, E. (2013), "On the importance of behavioral operational research: The case of understanding and communicating about dynamic systems." *European Journal of Operational Research*, 228(3), 623-634.
Hämäläinen, R. P. and Saarinen, E. (2006), "Systems intelligence: a key competence in human action and organization life." *The SoL Journal*, 7(4), 17-28.
Hendriks, P. (1999), "Why share knowledge? The influence of ICT on the motivation for knowledge sharing." *Knowledge and process management*, *6*(2), 91-100.
Jackson, M. C. (2003), *Systems Thinking: Creative Holism for Managers*. John Wiley and Sons, Chichester.
Malhotra, Y. (2004), "Why knowledge management systems fail: enablers and constraints of knowledge management in human enterprises." In *Handbook on Knowledge Management 1*. Springer Berlin, Heidelberg.
Nonaka, I. and Konno, N. (1998), "The concept of "ba": Building a foundation for knowledge creation," *California Management Review*, 40(3), 40-54.
Nonaka, I. and Konno, N. (1999), *Chisiki Keiei no Susume (An Introduction to Knowledge Management)*, Chikuma Shobo, Tokyo. (In Japanese)
Nonaka, I. and Takeuchi, H. (1995), *The Knowledge Creating Company*. Oxford University Press, New York.
Saarinen, E. and Hämäläinen, R. P. (2004), "Systems intelligence: connecting engineering thinking with human sensitivity." In *Systems Intelligence: Discovering a Hidden Competence in Human Action and Organizational Life*, Hämäläinen, R. P. and Saarinen, E (eds.). Helsinki University of Technology, Espoo.
Sasaki, Y., Hämäläinen, R. P. and Saarinen, E. (2014), "Modeling Systems of Holding Back as Hypergames and their Connections with Systems Intelligence." *Systems Research and Behavioral Science*. doi: 10.1002/sres.2276.
Sasaki, Y. and Kijima, K. (2010), "Hypergame modeling of systems intelligent agents." In *Proceedings of the 7th International Conference on Service Systems and Service Management*, Tokyo, Japan.
Senge, P. M. (1990/2006), *The Fifth Discipline: The Art and Practice of the Learning Organization*. Doubleday, New York.
Toffler, A. (1990), *Powershift: Knowledge, Wealth and Violence at the Edge of the 21st Century*, Bantam Books, New York.
Tsai, C. H., Zhu, D. S., Ho, B. C. T. and Wu, D. D. (2010), "The effect of reducing risk and improving personal motivation on the adoption of knowledge repository system." *Technological Forecasting and Social Change*, 77(6), 840-856.