Review of Knowledge Creation Literature:
Some Issues in Theoretical and Methodological Foundations

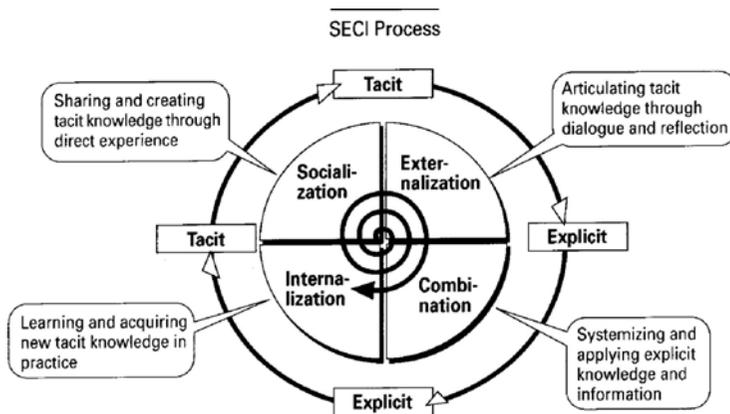**Anna Lyude**

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SECI

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I.　　Introduction

Nonaka's theory of organizational knowledge creation has won paradigmatic status since its publication in the mid-1990s (Nonaka &Takeuchi, 1995).[1] The number of its citations has increased year by year, as has the range of categories of journals in which this publication has been cited. It has also been widely described as "highly respected" and influential by many academicians and practitioners (Serenko& Bontis, 2004).

Initially, I palnned to examine front-line teams at manufacturing organization in terms of knowledge –creation and apply Nonaka & Takeuchi SECI model of organizational knowledge creation to a shop floor level. However, attempts to review and adapt a preceding empirical research relevant to

a dynamic nature of the model revealed scarceness of such if any. I have not only met no following surveys conducted to test the original theory, but also found out that the bulk of Nonaka's work relies on case studies and observational methodologies to the exclusion of experimental validation. Eventually, I have concentrated on investigation of the critical approach to the theory of knowledge creation.

The theory rests on the assumption that knowledge is created through social interaction between tacit and explicit knowledge. Nonaka and his colleagues postulated four modes of knowledge conversion corresponding to different forms of such interaction (Figure 1).

Figure 1. SECI Matrix.

Source: Adapted from Nonaka and Takeuchi, 1995.

According to their framework, knowledge creation begins with socialization (S), continues with externalization (E), combination (C), and internalization (I), and returns to socialization, but at a new level, due to the metaphor of a spiral of knowledge creation (Nonaka, 1991a, 1994, 1995; Nonaka, Konno, & Toyama, 2001; Nonaka & Takeuchi, 1995 pp. 57, 62, 71).

Although this matter was not addresses in the discussed volumes, it seems of some use to point that three of these modes have already been discussed in writings on organizational theory to some extent. Socialization, for example, is similar in content to theories of group process and organizational culture. Combination has its roots in the information-processing paradigm. Internalization is closely related to the learning organization and learning by doing concept. Externalization, with its attention to a transformation of highly personal tacit knowledge into articulated one, however, had been neglected in the literature preceding Nonaka`s work, so it might be understood as a unique element of SECI model.

The key ideas of organizational knowledge creation, first published in 1991 (Nonaka, 1991a), drew on studies of information creation in innovating Japanese companies (Nonaka, 1988a, 1988b, 1990, 1991b). Subsequently, Nonaka (1994) published a more extensive theoretical paper and the results of a

survey that validated the model (Nonaka, Byosiere, Borucki and Konno, 1994). In 1995, the booklength exposition of the theory appeared where the SECI matrix (Figure 1) is described as the "engine" of knowledge creation. Other parts of the theory describing how new knowledge becomes organizational knowledge have since undergone considerable modification (Nonaka, Toyama, & Byosière, 2001b; Nonaka, Toyama, & Konno, 2000), but the SECI "engine" remained intact.

As widely discussed, management of knowledge is very important for a variety of reasons. Then it is equally important to have good models to assist or lead this process. The famous SECI model seems to have been accepted by the knowledge management community as universally valid in conception and implications (Glisby and Holden, 2003). However, more intent research reveals that, as will be shown further, different aspects of the SECI matrix have been found questionable, calling the entire theory in question. Despite the fact Nonaka and his colleagues have never addressed the issue in their works, these are serious criticisms that anyone wishing to use Nonaka's theory must be aware of and take into account.

Thus, generalized observation of critical opinions together with analytical review of the literature denounced composes the present paper's purpose. Possible theoretical and practical implications are also provided.

II. Piecemeal Criticism of the Knowledge Creation Theory

On its long triumphant existence in the center of knowledge management literature, Nonaka's theory appears to have attracted little systematic criticism. However, several authors have highlighted important contingent factors.

Becerra-Fernandez and Sabherwal (2001), for example, reject the universalistic nature of the SECI model proclaimed by Nonaka and his colleagues. They treated the four modes as the knowledge management processes and showd that each of the SECI modes is dependent on the presence of appropriate task characteristics. Moreover, empirical tests demonstarted low use of the externalization process in the organizational knowledge management, which suggested deeper thinking of and creating better tools and techniques facilitating this part of SECI.

Poell and van der Krogt (2003), treating the modes as forms of learning, also report that the type of work involved influences how workers learn. They show Nonaka and Takeuchi's theory of knowledge-creating companies to be problematic in at least two respects. First, it assumes that workers will learn only within the boundaries set by management and does not, at the same time, take into account that workers organize a great deal of learning themselves, frequently irrespective of management expectations. Second, Nonaka and Takeuchi are said to expect workers to learn according

to rigid bureaucratic principles in a work context emphasizing innovation. Poell and van der Krogt (2003) blame the theory of knowledge creation for not explaining how these contrary principles might be successfully integrated.

More generally, Glisby and Holden (2003) argue that the model rests on tacitly embedded Japanese management cultural practices, and is thus not transferable to other contexts. Other empirical criticisms include Engestrom's (1999) discovery that problem finding is an important part of innovation missing from the SECI model, and Poell and van der Krogt's comment concerning the importance of self-organized learning, particularly in professional organizations.

Questions also have been raised about the theory itself. Adler (1995) suggested that Nonaka's discussion of externalization may not be generalizable, and pointed out that although the other modes had been previously studied, Nonaka and his colleagues neglected that research. Jorna (1998) argued that Nonaka neglected learning theory, especially in his discussion of tacit and explicit knowledge. He also charged Nonaka and his colleagues with misreading important organizational writers, and suggested that better accounts of Western philosophy were available than those used. In addition, Jorna argued that "knowledge conversion" entails semiosis, but the model lacks a semiotic framework.

Nonaka's conceptualization of the relationship between tacit and explicit knowledge has also been criticized. While Nonaka treats tacit and explicit knowledge as separable, other theorists regard tacit knowledge as always necessary for explicit knowledge to be understood (Adler, 1995; Tsoukas, 2003). More generally, Griffin, Shaw, and Stacey (1999) suggested that Nonaka has subordinated Polanyi's (1969a, 1969b) concept of tacit knowledge to an objectivist strategic management theory, while arguing that the SECI model employs a mixed ontology, trying to be both constructivist and positivist.

Recently, four important shortcomings in Nonaka's approach have been identified (Gourlay & Nurse, 2005). They argue that first, Nonaka's theory cannot explain how minds produce (or fail to produce) ideas. Second, it overlooks the important question of understanding—in order to learn by doing, one has to know what to observe. Third, while the theory recognizes knowledge abstracted from context, it says little about how it can be managed. Finally, it is said that Nonaka`s view that knowledge originates in individual minds prevents him from conceptualizing knowledge that arises from collective actions, for example, as a product of teamwork. Overall, this sever critique argues that the theory is rooted in a folk epistemology that regards individual minds as full of unformed knowledge that must be projected into an external world, an approach that hinders any attempt to provide a theory of knowledge creation. As such, it is suggested that Nonaka's theory fails both as a theory and as a practical tool for business (Gourlay & Nurse, 2005).

Yet, while all these remarks suggest the SECI model is somehow flawed in regards to methodological and theoretical grounds, majority of their authors were only tangentially interested in

Nonaka's theory and did not develop a system of critique. Consequently, existing criticism remains largely piecemeal, and within organization and management studies circles the theory of knowledge creation remains largely unchallenged and moreover, taken for granted.

III. Analysis of the Methodological Basis for the SECI Matrix

In contrast to a great number of scholars supporting the knowledge –creation theory, Gourlay and Nurse have drawn the attention of the research community to its criticism. In their view, the "engine" of Nonaka's theory of organizational knowledge creation is fundamentally flawed on both empirical and theoretical grounds. As such, its utility—especially as a guide for organizational intervention and knowledge development—is questionable (Gourlay & Nurse, 2005; Gourlay, 2003). As a basis for their systematic critique, the authors initially review the empirical evidence for the model, and then turn to key conceptual dimensions of the theory.

In 1993, 105 questionnaires designed to test Nonaka's emerging theory of knowledge creation were mailed to Japanese male middle managers (Nonaka et al., 1994). The survey comprised 185 items, 38 of which concerned "the content of organizational knowledge creation," as measured by the amount of time spent on specific activities (Nonaka et al., 1994, pp. 342–343, 350). Hierarchical confirmatory factor analysis of the data confirmed the suggestion that knowledge creation comprised four modes of knowledge conversion, thus validating the SECI hypothesis (Nonaka et al., 1994; Nonaka & Takeuchi, 1995).

Nonaka and his colleagues (1994) raised a number of cautions about this work: (1) this was the first time the questionnaire had been used, except for piloting; (2) the heterogeneity of the sample raised questions of internal validity; (3) the generalizability of the findings to other cultures was questionable; and (4) qualitative data would have enriched the study. According to Gourlay (2006), there are, however, more fundamental issues involved than those noted by the researchers.

First, the survey focused on the *content* of organizational knowledge creation, while *process* issues remained to be investigated. Yet, since the SECI model is a process model, the claim that the survey validated Nonaka's hypothesis cannot be accepted. Second, it is not clear how scales for measuring the knowledge conversion modes could have been constructed given the lack of previous research. Although it is told that externalization had only been studied in the context of research into semantic information creation (Nonaka, 1991b; Nonaka et al., 1994), it appears that the only data available at that time was from such studies (Gourlay & Nurse, 2005). Thus, readers are forced to conclude that the measures of knowledge conversion mode content actually came from studies of semantic information creation. Insofar as Nonaka has made much of the difference between information and knowledge

(Nonaka & Takeuchi, 1995), this suggests that the 1993 survey actually focused on semantic information creation. It means, that in order to set these difficulties aside, one should argue for example that semantic information and knowledge are equivalent, which is contradictory.

Another important difficulty is concerned with the results interpretations. In confirmatory factor analysis, it is normal to accept a factor when at least 60–70% of the variance has been accounted for (Hair, 1984). While the percentage of variation explained for socialization (73%) and combination (64%) do fall within these limits, the figures for externalization (51%) and internalization (56%) fall below them. Thus, one can doubt, whether to accept the claim that the survey "validated the existence" (Nonaka & Takeuchi, 1995, p. 91) of the four knowledge creation processes. Taking into account contradiction given above, one may speculate that, at best, the support for two of four hypothesized modes of semantic information creation was provided.

The critique concerning the empirical bases of SECI model can be summarized as follows. Turning to the case study evidence, as noted earlier, most if not all this data were originally collected for studies of innovation and information creation. It does not appear that studies of knowledge creation were carried out as part of the theory development process. While it might be quite acceptable to reinterpret data in light of a new theory, as we have just suggested, Nonaka has not justified treating semantic information as equivalent to knowledge. Moreover, much of this illustrative material is itself far from convincing due to methodological inconsistency.

Indeed, the complex, cross-disciplinary nature of the knowledge-creation related research has both positive and negative sides. Being challenging and cross-disciplinary on the one hand, it brings together the conceptual and theoretical power of several disciplines in a single research design and, therefore, is more likely to penetrate through boundaries that are very relative in the real life. On the other hand, we can see that non-existence of a solid theoretical domain may guide any study to arbitrary empirical methods.

IV. Analysis of the Knowledge –Creation Theory Conceptual Framework

Among critiques for the conceptual framework of the knowledge-creation theory, Nonaka's approach to tacit knowledge, the SECI process, and the implications of their particular definition of knowledge will be considered.

As widely known, Nonaka took the notion of tacit knowledge from Polanyi (1969a,1969b) and modified it in a "practical direction" by distinguishing technical tacit knowledge (concrete know-how and skills) from cognitive tacit knowledge (mental models of the world)(Nonaka, 1994; Nonaka &Takeuchi, 1995). Tacit knowledge is a "rich, untapped source of new knowledge" and is the basis of

organizational knowledge creation. Such tacit knowledge is difficult to communicate or share because it has "a personal quality ... [and is] deeply rooted in action, commitment, and involvement in a specific context" (Nonaka, 1994; Nonaka & Takeuchi, 1995; Nonaka et al., 2001b).

Tacit knowledge is contrasted with explicit knowledge, and while they use the metaphor of an iceberg to refer to the relationship between these two forms of knowledge (Nonaka & Takeuchi, 1995, pp. 60–61), they more frequently treat them as separate entities. This tendency is reinforced by the "assumption" that their "social interaction" produces knowledge (Nonaka &Takeuchi, 1995, p. 62), a relationship that can be represented by a matrix. Some authors claim it difficult to see how the metaphor of an iceberg (a base-superstructure model) and of interaction can both be logically applied to the same relationship (Gourlay & Nurse, 2005). More important perhaps is that treating tacit and explicit knowledge as opposites is a more radical modification of Polanyi than the one they acknowledge (Adler, 1995; Tsoukas, 2003).

The next stage of critical analysis- analysis of the SECI process – also reveals some difficulties and inconsistencies. One problem with the SECI spiral concerns understanding what comes out of it. The key assumption is that "knowledge" is created through the interaction of tacit and explicit knowledge involving the four modes of "knowledge conversion" (Nonaka & Takeuchi, 1995, p. 62). At the same time, it is also told that through socialization and internalization tacit knowledge is created, and by externalization- explicit knowledge. Elsewhere, however, it is written that externalization results in "conceptual knowledge," and that each of the other modes also produces a distinct type of knowledge (Nonaka & Takeuchi, 1995, p. 72). Gourlay & Nurse (2005) conclude from the above, that thus we end up with six confusing types of "knowledge" - four created through the interaction of tacit and explicit - together with the grand product of this interaction: knowledge.

A further problem concerns understanding how one phase of activity relates to the next and the way through which case studies illustrate the four modes of SECI- they are called ambiguous and not explicitly relevant (Gourlay & Nurse, 2005). They also echo Poell and van der Krogt's (2003) concerning practical knowledge notion in the model. According to them "knowledge" as "justified belief" (as accepted through the discussed literature) simply means ideas and plans that have been sanctioned by those in authority. Yet, the SECI model is evidently a hypothesis about the generation of ideas for new products or processes that, when sanctioned by managers, acquire a special status, called "justified belief" by Nonaka and his colleagues. They are justified because they meet predefined criteria and presumably they are beliefs because managers believe them.

Summarizing the above discussions, Nonaka and his colleagues' "engine" of knowledge creation has been found flawed in both theoretical and methodological foundations as follows. First, it appears that the data for the SECI modes of knowledge conversion came largely, if not entirely, from studies of

semantic information creation, while the necessary explanatory links between semantic information and knowledge are missing. Second, claim that a survey validated the SECI hypothesis cannot be accepted because it too draws completely on the semantic information studies. The survey focused on content not process, and on the most generous interpretation only provides support for two of the four modes of conversion. Third, examination of the case study evidence reveals ambiguity about the four modes, lack of detail or clarity about the processes, and an absence of convincing examples. Furthermore, there is no persuasive evidence that "knowledge" is created by the interaction of tacit and explicit knowledge, the key assumption on which the whole model was based.

Turning to their concepts, they have used an unjustified monolithic notion of tacit knowledge, whereas other authorities argue for and provide illustrations of two types, one that can and one that cannot be made explicit. Nonaka and his colleagues only recognize the former, and their matrix cannot be modified to accommodate the latter. There are also important ambiguities about the SECI processes, in particular the relation between the different types of knowledge alleged to be involved. These problems can be resolved when it is appreciated that "knowledge" as "justified belief" actually means managers' beliefs that product or process ideas appear to meet pre-established criteria. Thus the SECI process should be described as a hypothesis concerning the production of managers' "justified beliefs." Making "knowledge" a matter of authority harks back to pre-modern practices in Europe. While this may reflect the way employees' ideas are treated by managers, there is a strong opinion that had authority been the judge of knowledge we would probably still think the earth was the center of the universe (Gourlay, 2006).

Such a radical redefinition of the word "knowledge" hinders communication and thus development of understanding about whether and how knowledge might be managed. Finally, since the SECI matrix is the core of Nonaka and his colleagues' theory of organizational knowledge creation, and that core now been shown to be empirically unsupported and conceptually flawed, we may question whether the rest of the theory can be sustained. The SECI model and related ideas have undoubtedly been of heuristic value and may have generated insights that will turn out to be more than someone's justified beliefs. Its value, however, has now been questioned severely, and a necessity to begin afresh theory building, at a higher level than before is pointed (Gourlay & Nurse, 2005; Poell and van der Krogt, 2003; Gourlay, 2003).

V. Theoretical and Practical Implications for Knowledge Management Theory

Although, it does not appear that Nonaka and his colleagues have responded, either directly or indirectly, to any of these critiques, they are serious issues that raise questions about the utility of the

model as a guide to research and practice.

From the above standpoint, the following ways may prove fruitful. First - and indeed much work has already been done or is under way - researchers need to work to develop useful theory. The research world needs to be provided with clear evidence on whether or not "knowledge" is manageable, and if so in what sense. If, as widely debated, knowledge management is to progress and provide useful advice, we need common working definitions of the concept.

Definitely, establishing such definitions will not be an easy task. Browsing the literature one gets the impression that "knowledge" is an extremely loose word, for which it is impossible to give a precise definition (Jorna, 1998). Fighting with the challenge in the area of organizational knowledge management, authors have extended "knowledge" to cover something "embedded" (or "embodied") in "technology" (Teece 2001, pp. 126–130; Nonaka & Takeuchi, 1995, pp. 223). A review of knowledge-related concepts in each relevant field - be it learning and education or artificial intelligence- reveals a further lack of agreement and constant emerging of new approaches.

This is probably too much to say that we can do no useful work unless or until we agree on a definition of knowledge. However, in the absence of consensus on a working operationalizable definition of knowledge, knowledge management researchers could at least be more explicit about which definition they are using. If so, the effects of using different perspectives can be discussed, and consensus can emerge on which approach seems more useful than others. But being a student in this field I came to a strong believe that unless this confusion is recognized and clear and unambiguous meaning of what we mean by "knowledge" is developed and shared, we are unlikely to make sufficient progress. It is even still ambiguous, whether what we now call "knowledge" was previously called something else, for instance, "information", as in the case with SECI model.

It may be also potentially useful to conduct systematic reviews of existing research in knowledge management in order to determine the extent to which something new is being studied. What the dimensions and characteristics of that new object are. This implicitly bottom-up approach to establishing what the field of knowledge management is concerned with is a necessary task complementary to that of theory-building and synthesis. As one can judge from the literature referenced in the present paper, all these kinds of work are already taking place giving birth to various handbooks and articles. I would just like to underscore the importance of it once again.

VI. Conclusions

First of all, it should be noted that critical analysis presented here have focused on reviewing the evidence, arguments, and theoretical concepts of the "engine" of knowledge creation-SECI model.

Knowledge management projects that have been inspired by the SECI matrix, or other components of knowledge-creation related models, have not been reviewed. This paper is far from saying that Nonaka`s model should be abandoned. Rather, I argue that it should be seen as a map suggesting direction of knowledge management practices more than a model. So it is very possible that useful innovations in the management of knowledge have been inspired by the SECI matrix. However, as, for instance Gourlay and Nurse (2005) argue, any such successes could not be explained by Nonaka and Takeuchi's theory for the reasons given above. Any successful cases need to be studied in some depth to determine exactly where they originated in.

The next practical point concerns the management of tacit knowledge, which is widely agreed to be critically important. If it cannot be converted fully into explicit knowledge, a researchers need to be alert to other ways of managing it. Recently, many successful examples (including those, given by Nonaka and his confederates) are based on teamwork. In the light of it, the use of teams does appear to be a useful way of unlocking and sharing tacit knowledge through learning-by-doing etc processes. The notion of communities of practice, natural or contrived, comes to mind in this context. This observation, in turn, suggests that perhaps some tacit knowledge can only be managed by particularly sensitive ways of managing people and makes knowledge management inseparable with the human resource management and development. The idea that it might not be possible, or perhaps not fruitful, to separate "knowledge" from the context of its use also leads our attention toward managing production processes and the design of work more generally, as well as to the management of people. Of course, this is not the only way open to managers- as it can be seen in practice- they can and do try to diminish reliance on tacit knowledge by redesigning products, production processes, or both, through so called deskilling processes, standardization, modularization etc.

When speaking about knowledge management it is a mistake to forget that the needs of organizations differ greatly from one another. Organizational knowledge creation theory was developed through studying innovative organizations, and such organizations have special knowledge management needs. An innovating organization, one that implicitly introduces changes to products, processes, or to both, must have management structures that facilitate the generation of new ideas and their evaluation and dissemination throughout an organization. Some of the kinds of management and work processes that might help are those discussed by Nonaka and his colleagues and being implemented at successful Japanese and Western corporation. If Nonaka is right to suggest that individual employees are or can be an important source of new ideas originating in working practices, and new ideas are important to an organization, then clearly means need to be established to capture those ideas and to bring them into the public domain. Critical approach representatives are simply suggesting that it does not appear useful to conceptualize such processes in terms of tacit–explicit knowledge transfer, or to confuse ideas with

knowledge (Gourlay, 2003; Gourlay & Nurse, 2005). On the contrary, companies or enterprises that compete in ways that do not depend so highly on innovative practices implicitly do not need the same kinds of knowledge management practices. They will be less interested in generating new ideas than in the management of routine, by, for example, reusing knowledge and documenting best practice rather than reinventing the wheel to cope with repetitive problems. In this context, SECI model and relevant discussion probably is of little interest. Different models suit different kinds of firms, and firms that do not need to innovate in the highest way, can well stick with "first-generation" knowledge management, otherwise known as information management (Gourlay, 2003).

Finally, what personally I believe to be another and highly important practical lesson for academic and managerial practitioners - claims to knowledge (including what is generated in the present paper) should be treated with informed and critical skepticism. It might sound obvious, but all levels of "consumers" of academic research, and particularly of such popularized versions, as Nonaka and Takeuchi (1995), must become sophisticated critical readers. This means that we must learn to ask questions about the nature of evidence being offered to support a claim; we must ask how that evidence was collected and question whether the data collection methods were valid. We should also examine if the data has been analyzed adequately, or if it is open to alternative interpretations, and we must learn how to evaluate the linkages between evidence and claims. Nonaka and other scholars may have paid attention to some of the methodological limits in tests of the original SECI model (Nonaka et al., 1994). However, Gourlay (2003) mentions, that their cautions went unheeded in a market for ideas that was crying out for a model of knowledge creation in the mid-1990s. Nowadays market of knowledge management ideas became even more complicated. So, today's researcher should be very careful when building his own logic of knowledge management research or practice.

Endnote

[1] Nonaka and Takeuchi (1995) volume has been cited over 1,000 times between its publication in 1995 and October 2004(Serenko& Bontis, 2004).

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