

December 2002

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Recommended Citation

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TACIT KNOWLEDGE TRANSFORMATION AND INFORMATION

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Abstract

This paper is the beginning of a series of investigations examining the role of innovative Information Systems technology to aid in the transformation of tacit knowledge to an explicit form that can be disseminated within the organization. This research-in-progress reviews the formal theoretical foundations that assist IS researchers in this goal. While management theory addressing knowledge creation assists in the general problem of tacit knowledge transformation, we suggest that existing IS theories are inadequate to explain how IS contributes to this process. We suggest that formal learning processes embedded in e-learning technology may provide a significant contribution. Theories of learning provide a rich framework, but as yet, no formal e-learning theory exists. Questions surrounding a theoretical framework for tacit knowledge transformation are presented. A case study will be presented which addresses validating the dominant variable for further investigations, i.e., what tacit knowledge is important to this business for a particular situation.

Keywords: Tacit knowledge, knowledge creation, e-learning, theory, organizational learning

Introduction

Market leadership for a firm results from its ability to nurture and enhance its competitive advantage(s). Competitive advantage arises when the firm deploys unique competencies within its products and services, or within its internal operations. “The one sure source of lasting competitive advantage is knowledge (Hitt, Keats, DeMarie 1998).” We assert that tacit knowledge lies at the heart of sustained competitive advantage. Tacit knowledge relates to contextual, applied information that exists within individuals yet has not been reduced to verbal or written expression. It precedes expression and therefore is the core of competitive advantage.

This paper begins a series of investigations to examine the role of information systems contribution toward assisting in the processes of identification and distribution of tacit knowledge within an organization. The paper forms a foundation for further study by laying the groundwork of the theoretical background justifying the development of IS theory for transforming tacit knowledge. Such theory, it will be shown, does not yet exist.

In the following section, we explain the general research question to frame the scope of the opportunity. Next, we define tacit knowledge and its value within a business context. We provide a literature review referencing theory that provides some contribution to addressing our overall research question. We explain our conclusion relating to the absence of comprehensive theory for answering this question and suggest a theoretical framework. We discuss a case study which involves interviewing executives within a large, IT organization to address how to identify transformed tacit knowledge that would be beneficial to the firm.

Research Question

Administering explicit knowledge has been the dominant logic for information processing. Earlier generations of information systems sought automation as their goal, and it can be argued that information systems supporting knowledge creation are quite immature. Therefore, we seek to understand the underlying constructs that influence the success of a tacit transformation-oriented information system. At a highly generalized level, the question becomes: Can information technology contribute to the process of transforming tacit knowledge into explicit knowledge to aid the ongoing competitive advantage of organizations?

Perhaps due to the immaturity of a particular technology, or to the integration of evolving technologies, we can speculate, but cannot point to specific research, which demonstrates the contribution of information technology to the process of identifying and transforming tacit knowledge for the benefit of the organization. This question provides the focus to our ongoing investigation.

Tacit Knowledge

Michael Polyani did not initiate the study of knowledge, but his research into knowledge provides seminal work in the contemporary study of knowledge, and particularly, tacit knowledge. In *The Tacit Dimension* (1966, 1983), he notes “*we can know more than we can tell.*” This commentary frames his definition of two types of knowledge: explicit, which has been expressed either verbally or in written form; and tacit, which has not yet been expressed. The psychological roots emanate from Gestalt and cognitive psychology that presuppose that functions of the brain are more complex than for which previous behaviorism could account. Tacit knowledge, he asserts, requires attenuation; if one shifts one’s attention from a particular focus or situation, the tacit knowledge dissipates.

Ikujiro Nonaka (1991) clearly explains the importance of tacit knowledge: “In an economy where the only certainty is uncertainty, the one sure source of lasting competitive advantage is knowledge.” He frames tacit knowledge as the key to organizational success. Tacit knowledge, he explains, is embodied in “highly subjective insights, intuitions, hunches, and personal commitments.”

Contribution Value

Strong methodology seldom compensates in value for weak theory. A contribution value of this paper is to propose a framework for future research for developing of a theory of tacit knowledge transformation. We suggest that popular information systems theories do not encompass the critical aspects of tacit knowledge and of information systems’ contribution to the process of tacit knowledge transformation. We suggest that information technology has achieved maturity to assist in this process and merely lacks integration between technological components with cross-disciplinary theory.

Is tacit knowledge so important? As reported in Hitt, et.al., (1998), “companies that rely solely on improving productivity are not likely to survive. Only those firms that develop and market new, unique goods and services gain an advantage over their competitors.” These new, unique goods and services rely on tacit knowledge for development.

As a further contribution, the proliferation of theories within IS detracts from progress in developing a cumulative body of knowledge. The process of development of research implicit in this paper also suggests future theory development, prior to proposing unrelated theory, provide a reasonable investigation into contemporary research to examine contributions and limitations.

Theoretical Background

We begin with the assertion that no comprehensive theory exists which responds to our research question relating to how IS can contribute to tacit knowledge transformation. Therefore, we take an investigative approach within various disciplines to seek contributions. The most critical of these investigations are reflected below in theory relating to knowledge, learning, and information systems.

Knowledge Theory

Boisot (1995) depicts a “social learning cycle” whereby codified (explicit) knowledge and uncoded (tacit) knowledge are intertwined in a cyclic process of diffusion, absorption, scanning, and problem solving among participants (see Figure 1). Boisot also sees the social learning cycle as superior to an individual one as the tacit knowledge uncovered is not only more extensively diffused into the organization, but that the group involved delivers a more expansive set of tacit knowledge for that diffusion.

Grant (1996) contributes another valuable insight; namely, tacit knowledge is *knowing how* (while explicit knowledge is *knowing what*). In addition to Grant’s *knowing-how*, this author suggests that tacit knowledge often includes *knowing why* and *knowing when*, particularly for strategic initiatives. It is not enough just to come up with novel observations and ideas of no particular purpose, application, or market timing.

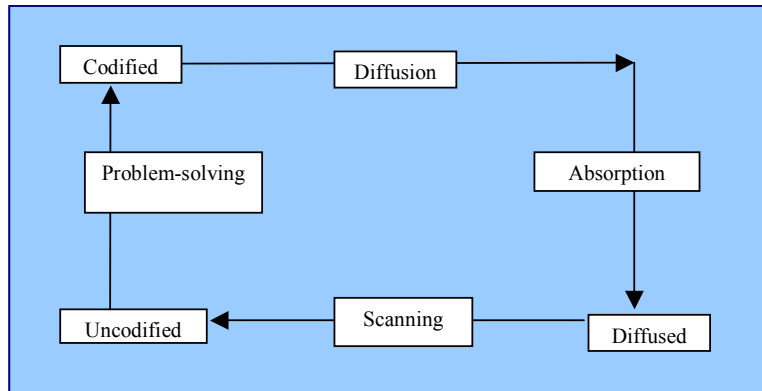


Figure 1. Social Learning Cycle

Little knowledge management research ignores the work of Ikujiro Nonaka who may provide the most succinct, yet comprehensive, view of knowledge transformation. As seen in Figure 2, knowledge is correlated among the combinations of tacit and explicit knowledge. When tacit knowledge flows from one individual to another and remains tacit knowledge, this transformation is called “socialization.” When tacit knowledge is made explicit, this transformation is termed “externalization.” When explicit knowledge joins with additional explicit knowledge, this transformation is seen as “combination.” And, when explicit knowledge inspires new tacit knowledge, this transformation yields “internalization.” As might be surmised, Nonaka sees these transformations as a continuing spiral in successful organizations.

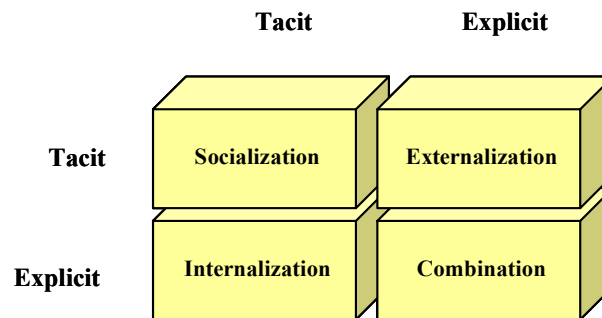


Figure 2. Nonaka's Knowledge Spiral

Knowledge Creation Theory

Nonaka and Takeuchi's theory of organizational-based knowledge creation (1995) insists that management, particularly Western management-thought, must move beyond valuing mainly formal and systematic data: codified procedures, hard data, and universal principles.

The Nonaka model (1991) of transforming knowledge involves three elements: metaphor, analogy, and conceptual model.

Metaphor: The tacit consciousness has not yet been reduced to words. Its language is ethereal, certainly in its earliest form. Metaphor is a distinctive method of perception, which can ground tacit knowledge of different contexts and from different experiences into something more concrete. The use of imagination and symbols helps people understand intuitively what they have yet to express verbally.

Analogy supports the synthesis of varied and possibly contradictory images and perceptions into a commonality of expression. With analogy, comparative messages are compared and contrasted: How are they similar? Where do they differ?

Building the conceptual model adds organizational value to ideas and messages. In the conceptual model, contradictions are resolved and concepts “become transferable through consistent and systematic logic.” It is not enough to have an innovative idea; the idea must provide value to the organization in step with its strategic focus.

Knowledge as Learning

Peter Senge, at MIT, notes that learning is NOT different from knowledge (Meen & Keough 1992). Senge, quoting MIT colleague Fred Kofman, notes, “learning is the enhancement of or increase in knowledge, and knowledge is the capacity for effective action in a domain, where effectiveness is assessed by a community of fellow practitioners.”

The contribution of learning research may provide value to the tacit transformation process. Traditionally, organizations have relied on one of two primary methods of tacit transformation: (1) ad hoc or “water cooler” method, whereby, employees informally associate and share experiences and other information, and (2) job rotation, where employees transfer to other departments, sometimes temporarily, to become familiar with the goals, challenges, and experiences in the new department. As noted by Ireland, Hitt, Camp, and Sexton (2001), “High potential managers (*at General Electric*) are identified early in their careers and then rotated through a variety of units and jobs, rarely remaining in one position for more than two years. Broad exposure to GE’s businesses helps managers learn how to quickly pinpoint problems and propose solutions, recognize the value of entrepreneurial and strategic actions in different settings, and learn how human resources can be a source of competitive advantage.”

Knowledge-based theories of the firm are a fundamental input into the challenge of transforming tacit knowledge; however, technology’s contribution lies outside this theory. Knowledge-base theories at present suggest actions and processes which are not significantly changed by the presence or absence of technology.

Further, the two traditional methods (of transforming tacit knowledge) lack a formal process. Learning, on the other hand, in the form of education, has a rich heritage encompassing exploratory modes of knowledge acquisition.

Learning Theory

Ausubel (Driscoll 2000) distinguished the process of learning as being between discovery learning and reception learning. Discovery learning requires the learner to discover missing elements of a relationship or to rearrange an integrated structure to create a desired end-product. Ausubel also noted the differences in the goal of learning as being meaningful or rote. Rote relies on memorization, but does not include the element of understanding the content. Meaningful learning requires that the learner understand what concepts the phrases or formulas are intended to mean. We suggest that tacit transformation is expected to require discovery and meaningful learning much more than is expected for explicit learning. Because meaningful learning depends heavily on the learner’s previous knowledge and experiences, it aligns well to tacit transformation which relies on the same constructs as elements of tacit knowledge.

Learning theory provides insights as to what induces individuals to be cognitively receptive to acquiring information and knowledge. It does not address information systems technology. And while e-learning exists, a substantial e-learning theory has yet to emerge.

Information Systems Theory

Information Systems theories abound on many subjects. Figure 3 exemplifies the lineage of IS theories relating to IS adoption. These adoption theories provide the best hope of extracting concepts relevant to tacit knowledge transformation. The most notable, Diffusion of Innovations (DOI), Technology Acceptance Model (TAM), and Adaptive Structuration Theory (AST) will be reviewed. DOI and TAM relate to the individual as the unit of analysis while AST focuses on the organization.

Postulated by Everett M. Rogers in 1962, Diffusion of Innovations Theory is one of the most enduring of IS theories. Rogers defines “diffusion” as “the process by which an innovation is communicated through certain channels over time among the members of a social system” (1995, p. 5). Rogers subscribes eight dimensions to the process of diffusion:

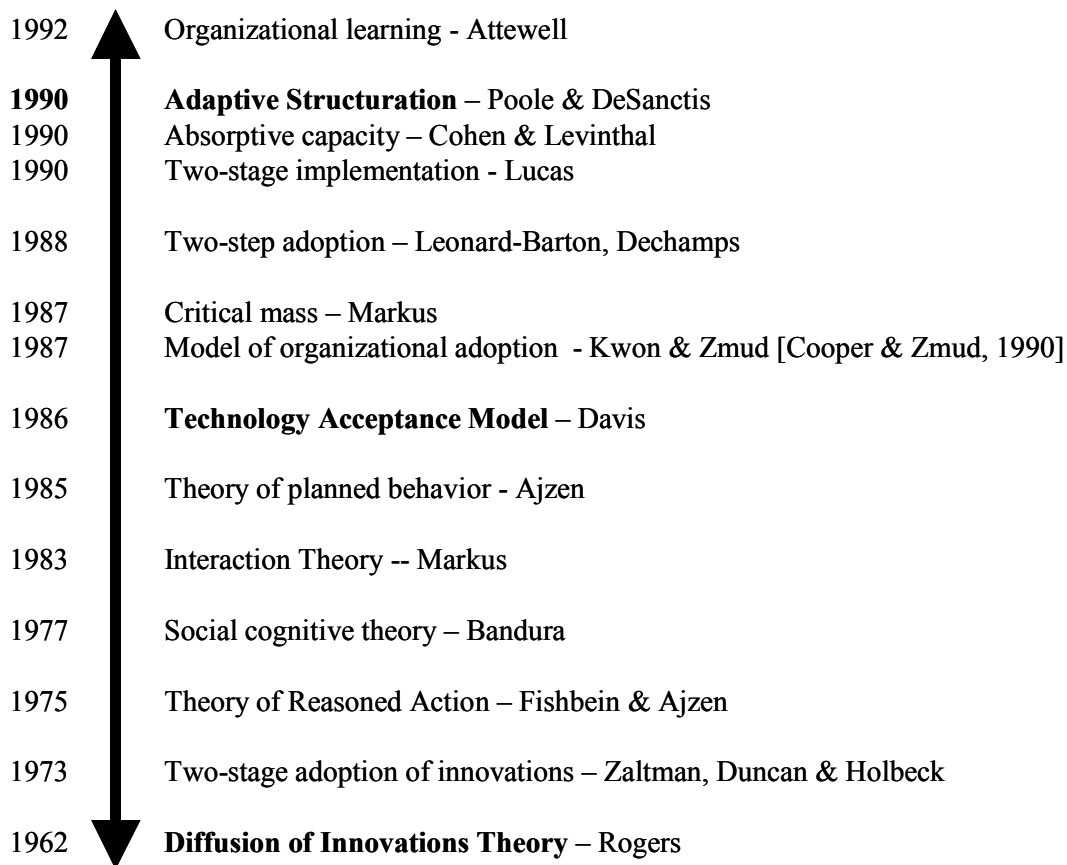


Figure 3. Technology Adoption Theories

1. Earliness of knowing about innovations
2. Rate of adoption of different innovations in a social system
3. Innovativeness
4. Opinion leadership
5. Diffusion networks
6. Rate of adoption in different social systems
7. Communication channel use
8. Consequences of innovation

Fichman (1992) notes that much of diffusion theory relates to the context of recipients having made preconceived value judgments on the benefits they hope to derive from an innovation. Both Rogers and Fichman viewed innovation as “any idea, practice or object that is perceived as new by the adopter.” Subsequent researchers have expanded these views on innovation diffusion. Szulanski (1996) delineates the learning of explicit knowledge into diffusion (a gradual process of dissemination) and transfer (a distinct experience for the movement of knowledge within an organization). Diffusion does not address the recipient; transfer does. In knowledge transfer, he highlights an apprehension on the part of the recipient. Arrow (1969) describes the difficulty of transferring knowledge to a recipient as “internal stickiness,” with four characteristics: aspects of the knowledge transferred, of the source, of the recipient, and of the context in which the transfer takes place.

Diffusion theory does not address tacit knowledge. It activates once new, explicit knowledge arises needing to move through the organization, and it largely addresses the individual as the unit of analysis. For tacit transformation, we are predominantly concerned with tacit knowledge and the organization as the unit of analysis.

The Technology Acceptance Model (TAM) could be considered an adolescent in IS lineage having been developed by Fred Davis in 1986. TAM considers two variables in predicting the acceptance of an information system: perceived usefulness and perceived

ease of use, with perceived usefulness being the most influential factor. It contributes to the need to sensitize a group as to the value of a technical solution and, to a lesser extent, to its ease of use. Yet it does not address the specific problem of identifying tacit knowledge and of transforming it to an explicit form. It, too, considers the unit of analysis to be the individual.

Adaptive Structuration Theory was formulated by Poole and DeSanctis (1990). With adaptive structuration, group systems are delineated by their procedures and practices. Information systems are merely a resource, important only to the extent that they support the group. Both technology and social context intertwine in aspects of “spirit” and “structure.” Structure refers to the rules and resources by which the system operates. Spirit relates to the culture and intensions relating to the system. Initially, designers envelop the system with their own intentions and operational culture. But both the spirit and structure of the system are modified by the interaction with its users. Repetitive interactions continue the modifications until the system develops a consistent process of operation and may result in technology operating with few of the same assumptions of the original designers. None of these IS theories explain the fundamental elements of tacit transformation. All concern themselves largely with the challenges associated with explicit knowledge. Most, excluding AST, focus on the dynamics of the individual. In the next section, we will offer a framework for tacit transformation.

Tacit Transformation Framework

In seeking an answer to our basic question, *Can information technology contribute to the process of transforming tacit knowledge into explicit knowledge to aid the ongoing competitive advantage of organizations?*, the framework for answering this question presupposes the following contributory questions are addressed:

- What is tacit knowledge? Polanyi, Nonaka, and others have provided sufficient answers to this question.
- What tacit knowledge is useful to the organization? An individual’s tacit knowledge may be unique, but it may not be useful for an organization. Further study is necessary on this question.
- Who is likely to possess tacit knowledge? Koskinen (2001) assumes tacit knowledge can be estimated for those demonstrating experience, commitment, and interaction of people.
- How do we identify tacit knowledge? Research relating to specific identification on tacit knowledge is needed; however, as Koskinen relates, tacit knowledge may only be possible to estimate.
- How do we transform tacit knowledge into explicit knowledge? No research is apparent identifying significant use of anything but ad hoc interactions or job rotation in organizations.
- How does the organization diffuse the explicit knowledge, once transformed? Diffusion and acceptance theories appear to adequately respond to the problem of explicit knowledge diffusion and acceptance of new information systems.
- How does an organization develop a repeatable process for tacit knowledge transformation? Some knowledge management strategies and technologies are parasitic in nature, searching and extracting information from files and email messages in the hope of finding useful snippets. What makes the process parasitic is that the owner of the information has not consented to the specific search, or to sharing the specific information. Implicit permission may have been provided, but often as a cost of employment. It has not been shown that such strategies retain their value over any significant period of time.
- Are there formal learning methods that can aid the identification and transformation of tacit knowledge? Whether we agree completely with Senge that knowledge is not different from learning, we accept that they are at least highly inter-related. Research is needed to examine if formal learning methods can be applied to the tacit transformation question.
- What information systems technology can aid the transformation of tacit knowledge? While the prior questions are prerequisites to establishing a tacit transformation theory, this is the question that brings relevance to the IS field.

Thus, a theory of tacit transformation must encompass all of these questions. To date, research exists to address some of these elements, but not all. Most knowledge management research addresses explicit knowledge.

Research Method

The current research initiates a series of investigations leading to the validation of a formal theory of tacit transformation. As an exploratory step supporting validation of the framework and primary constructs, a case study of a large, global, information technology corporation will be presented. Following the deductive approach to theory building (Lee 2001), we will begin with the framework proposed on tacit transformation. Through a series of semi-structured interviews, observation, and documentation review we will observe how questions are operationalized in an actual, industrial setting. Kerlinger (2000) notes that “the most important use of interviews should be to study relationships and to test hypotheses... respondent’s answers can be translated into

measures of variables.” As such, the interview results from this study provide valuable input into the guiding further phases of this research path.

From initial investigation, we expect the research to confirm that most current forms of tacit transformation are unstructured. Additionally, we expect to confirm that information systems contribute only indirectly and informally to the tacit transformation process. Finally, we expect that this study will ultimately validate a set of variables for which suspected valued, transformed tacit knowledge can be measured.

Summary

This paper discusses the value of tacit knowledge to an organization, the potential contribution of information systems to the process of tacit knowledge transformation, and of the lack of current IS theory to guide the investigations. Further, a framework for new theoretical development is suggested.

Additionally, a discipline for investigating new IS research topics is suggested. This paper establishes the first element of that discipline – establishment of contributions and limitations of current IS theory. The second element of this discipline would be the development of an initial theoretical framework for which specific analysis could be conducted for validation (the third element).

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