

THE TACIT KNOWING FRAMEWORK: A LOOK AT SUSTAINED COMPETITIVE ADVANTAGE UNDER A UNIFIED TACIT AND EXPLICIT KNOWLEDGE

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Abstract

Because tacit knowledge is an intangible firm resource, it is frequently assumed to be a key source of sustained competitive advantage in part because its intangible character provides for its non-appropriability. Like many intangible resources the processes through which managers employ tacit knowledge to capture and sustain competitive advantages is a mystery. It seems likely that tacit knowledge's intangible character would paradoxically work against its successful understanding and sharing within the firm. This article develops a framework based upon Polanyi's theory of tacit knowing. The framework explains how a *connected* and *related* rather than a dichotomous tacit and explicit knowledge may explain the paradox, meeting the resource-based view's criteria for sustained competitive advantage. The use of the framework adds clarity and structure to theoretical arguments and facilitates practical applications of organizational knowledge theory, especially as it pertains to sustained competitive advantage. Propositions and suggestions for future research are provided.

Organization Knowledge, Tacit Knowledge, Sustained Competitive Advantage

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Tacit knowledge is often identified as a key intangible resource (Jacobson, 1990) and primary strategic attribute of certain human resources (Coff, 1999). However, like many intangible resources the question arises as to whether tacit knowledge may be a source of sustained competitive advantage (Barney, 1986b; Barney, 1991). If tacit knowledge is indeed an intangible, can we then observe and discuss tacit knowledge and comment on its utility for organizations? Many researchers and practitioners who base tacit knowledge's value within organizations on its opacity and incomprehensibility, fail to explain how tacit knowledge helps to sustain firm competitive advantage (Baumard, 1999: 2).

The primary purpose of this article is to introduce the tacit knowing framework. I constructed this paper's framework using Polanyi's tacit knowing theory (Polanyi, 1958a/1962; Polanyi, 1958b; Polanyi, 1966), which argues that a dynamic and complex relationship exists between explicit and tacit knowledge. While various uses of the terms tacit and explicit knowledge appear in practical and theoretical literature, they often do not possess the dynamic suggested within this paper. I assert that this particular viewpoint on tacit knowing (1) provides a unifying framework for tacit and explicit knowledge that adds clarity to organization knowledge discussions in general, and (2) more usefully illustrates how knowledge may translate to sustained competitive advantage.

These assertions are supported within the paper by employing the tacit knowing framework in conjunction with the resource-based view's "empirical indicators" of sustained competitive advantage (Barney, 1991: 106). The tacit knowing viewpoint helps clarify apparent contradictions in the theoretical and practical treatment of tacit and explicit knowledge in a firm's quest for sustained competitive advantage. Testable propositions relating explicit and tacit knowledge to firm performance are developed, illustrating the utility of both the framework and the tacit knowing assumption. Implications for research and practice are generated, and recommendations for future research are also provided.

1. TACIT KNOWLEDGE

In this section I explain the distinction between Polanyi's dynamic treatment of tacit knowledge employed within this paper from various other definitional treatments of tacit knowledge. The uses of tacit knowledge in organization knowledge and other literature are not only diverse, they frequently operate under different assumptions that impede the application of theory and transfer of ideas. Divergence in use, meaning, and understanding of the tacit knowledge term can lead to very different conclusions by organization knowledge theorists and management practitioners. One of the advantages to using Polanyi's theory in the tacit knowing framework is the clarity it affords to future tacit knowledge discussions. In this section I present some of the more common uses of the tacit knowledge term to draw attention to the range with which tacit knowledge may be understood and clarify its meaning within the tacit knowing framework.

1.1 Tacit Knowledge Defined

The most frequently used explanation for tacit knowledge is "we can know more than we can tell" (Polanyi, 1966: 4). However, the highly portable statement was never intended by

Polanyi to stand alone as a definition of tacit knowing. For one thing, the ambiguity of the phrase used in isolation leads to the creation of many different definitions of tacit knowledge that may not mean the same thing to their users. The "we can know more than we can tell" declaration was intended to serve as an appetizing introduction to his more complex theory of tacit knowledge that he designed to reconstruct the western modernist view that knowledge is and must be explicit in nature (Gill, 2000). Under such a view, any definition of knowledge necessitates full articulation and objectivity or, as Gill points out results in a condition whereby one only "knows" when one can say what one knows (p.52). The wide-spread use of Polanyi's easily comprehensible surrogate definition of tacit knowledge combined with the theory's idiosyncratic terminology have undoubtedly slowed the adoption of Polanyi's more complex and ultimately more useful theory of tacit knowing.

Polanyi's use of the word 'tacit' to label his theory may also have contributed to the inconsistent use of both tacit and explicit knowledge. This is because tacit, as it is normally understood, is highly dichotomous. Unfortunately, as Ferreiro states, the dichotomy conveys the meaning of a number of other heterogeneous dichotomies. Tacit knowledge, when treated as a polar end to a continuum, may be linked with either explicit knowledge or some other supposed opposite as its antonym to suggest a meaning congruent with unconscious versus conscious (i.e., available to awareness), idiosyncratic versus shared (i.e., expressed through socially shared symbols), or "common sense" (i.e., socially shared) versus scientific knowledge, just to name a few (1994: 179). This would make the tacit part of tacit knowledge synonymous with things like unconscious, idiosyncratic, intuitive, or common sense knowledge. These terms are clearly not synonymous within the context of Polanyi's theory (Berg, 1994; Gill, 2000; Polanyi, 1966; Sanders, 1988). Tacit knowing and knowledge for purposes of discussion within this paper should not be confused with unconscious knowing (i.e., the type of knowledge that, even while in use, is unknown to the knower), pre-conscious knowing or non-conscious knowing (Schelling, 1968; Clement, 1994; Casey, 1999; Hatsopoulos & Hatsopoulos, 1999: 141). My use of Polanyi's tacit knowledge model for this paper provides a non-polar expansion of the tacit knowledge concept using a more detailed application of Polanyi's theory than may be found in other works.

In cognitive psychology, for example, the term tacit knowledge is widely used by a group of researchers engaged in intelligence testing and job performance prediction (Sternberg, Wagner & Okagaki, 1993; Sternberg, Wagner, Williams & Horvath, 1995). While this group cites Polanyi's 'know more than we can tell' statement and frequently use of the term "tacit knowledge" to define their approach, they equate tacit knowledge with Ryle's "know-how" (Ryle, 1949) and, more frequently, to practical or "everyday" intelligence (Mercer, Gomez-Palacio & Padilla, 1986; Sternberg et al., 1993; Sternberg et al., 1995; Sternberg & Wagner, 1986; Wagner, 1986; Wagner, 1987). Polanyi's theory of tacit knowing, however, uses *both* intellectual and practical knowing (Polanyi, 1966: 7) by integrating Ryle's "know-how" *and* "know-what" concepts in the model (1949). Polanyi's theory, therefore, employs a much broader portion of Ryle's philosophy than does the everyday intelligence group. Polanyi's theory also more explicitly emphasizes Merleau-Ponty's conception of knowing that emphasizes a relationship between body and psyche (Merleau-Ponty, 1962: 157, 166; Merleau-Ponty, 1963). These emphases in Polanyi's tacit knowing theory are included here to confer a unique multidimensionality to the paper's framework.

A final important contrast between Polanyi's conception of tacit knowing and other literatures concerns their respective motives. Work on everyday intelligence, for example, has focused primarily on the development of a testing instrument to broaden or complement general intelligence (IQ) testing. Polanyi's work, on the other hand, deals with a more general question of how people come to know what they know - that is, how knowing happens. This paper's framework advances theory in organization knowledge by bringing much needed dimensionality to the discussion while employing a rigorous model that directly addresses the fundamental question of how people come to know what they know.

2. INTRODUCING THE TACIT KNOWING FRAMEWORK

Polanyi's tacit theory is a seminal work in knowledge-related fields due, in part, to its practical and common sense appeal. More important, however, are the theory's sound logic and basic assumptions that make Polanyi's work a unique contribution to the theory of knowledge literature (Greene, 1977; Prosch, 1973: 201; Sanders, 1988). In constructing the framework I have employed Polanyi's basic assumptions and relied upon the work of tacit knowing theory scholars (Greene, 1977; Prosch, 1986; Sanders, 1988; Gill, 2000). Following some of their examples, I limit my use of Polanyi's idiosyncratic terminology to provide greater access to Polanyi's underlying theory and to avoid some of the dissensus and confusion that has surrounded tacit knowledge. The straightforward language of the framework should encourage the adoption of a more dynamic view of the tacit and explicit knowledge relationship based upon a model that is more representative of the human condition.

2.1 The Framework's Central Assumptions

The framework is based upon two sets of assumptions central to tacit knowing theory. These include assumptions concerning:

The Tacit/Explicit Knowledge Relationship

- True discovery can not be satisfactorily explained using explicit language.
- Tacit knowledge underlies and logically precedes explicit knowledge.
- It is impossible to make all knowledge explicit.

The Personal Nature of Knowing

- Knowing is a personal, intentional activity.
- Awareness, activity and cognition (personal coefficients) are central dimensions of personal knowing.
- Personal coefficients are integrated and inseparable from the act of knowing.
- All personal coefficients are present in the act of knowing.

The first set pertains to the nature of the tacit and explicit knowledge relationship. These assumptions pertain most directly to the rectangular boxes labeled knowledge, tacit knowledge, and explicit knowledge in Figure 1 below. The second set of assumptions

relates intentional human involvement as critical to the act of knowing. These assumptions pertain most directly to

Insert Figure 1 about here

the elliptical items in Figure 1 labeled focal object, subsidiary clues, and coherent pattern. These items are representative of a very personal component of human experience that essentially connects tacit knowledge with explicit knowledge. The integration of assumptions about the tacit-explicit relationship with assumptions about the personal nature of knowing cause the framework to function as it does. Our understanding of this integration along with details about each set of assumptions allow us to put the framework to use.

2.2 Assumptions about the tacit-explicit relationship.

The connections between tacit knowledge and explicit knowledge with knowledge in general (again, represented by their corresponding boxes in Figure 1) depend upon the extent to which the human animal, through experience, perceives and is capable of understanding a "hidden reality" (Polanyi, 1958a/1962: vii).

Beginning with the first set of assumptions, then, and working our way downward through the bulleted list, true discovery, including that which progresses science, can not satisfactorily be explained through explicit language. This means that whatever we may know about a certain subject explicitly, discovery must pull upon that which we know non-explicitly or tacitly. It is for this reason that the explicit knowledge box in the framework is smaller and within the confines of the tacit knowledge box. This argument is also related to the second assumption which states that unspecified or tacit knowledge underlies and logically precedes explicit knowledge. The explicit knowledge box is therefore represented within the tacit knowledge box. The next assumption is that it is impossible to make all knowledge explicit. Some non-explicit knowledge when made explicit changes in meaning. That is, the change of state of some knowledge from tacit to explicit also changes how that knowledge is understood. The conversion, in effect, also transforms our understanding. The tacit knowledge box logically should, in the framework layout, always contain and never be congruent with the explicit knowledge box. This would imply that no further discovery is possible. Additionally, the knowledge box, it should be mentioned, recognizes some greater knowledge, maybe even an ultimate truth, for which societies of humans are in search. This aspect of the framework was included to accurately represent a Polanyian view of "personal knowledge" which is neither traditionally objective nor traditionally subjective. Polanyi describes this more as a fusion of the personal and the objective (1958a/1962: vii). Although his complex arguments are beyond the scope of this paper, some feel for the personal knowledge concept can be found in the following section.

2.3 Assumptions about personal knowing.

That knowing is a personal, intentional activity is another assumption central to tacit knowing, and is the first assumption in the second set in the bulleted list above. This personal aspect factors human experience into the knowledge equation through the

additional assumption that human awareness, activity, and cognition are central components in human acquisition of knowledge. These three factors (awareness, activity, and cognition) are discussed at length by Gill (2000: 31-69) and are part of what Polanyi calls the "personal coefficient" necessary to all knowing (Gill, 2000: 53) which is another assumption. One reason for this is that they are descriptive of the human condition during the discovery process, i.e., the course of coming to know what we know. The awareness, activity and cognition factors are inseparable dimensions of tacit knowing that manifest through a simultaneous mixture of focal and subsidiary awareness, bodily and conceptual activity, and tacit and explicit cognition. This inseparability is the last assumption listed in the second group of assumptions.

Because these personal coefficients are assumed central to knowing, they serve as useful tools in the analysis of the tacit and explicit knowledge relationship. For example, persons are more likely, in attending to these three personal factors, to direct their focus toward likely explanations for the relationship between tacit and explicit knowing. It is also more likely that an examination of the relationships between each of the personal coefficients themselves and their components would result in a better understanding of the relationship between tacit and explicit knowledge itself.

Adapting an example from Gill, as a reader focusing on the meaning of the very words on this page, you are but subsidiarily aware of the fact that they are written in English, and that they follow certain rules of grammar, and so on (2000: 32). In framework terminology the focal object is the meaning of specific text while subsidiary clues consist of things like "written in English," "adjectives generally precede the nouns they describe," and others - including things not yet made explicit and things not specifiable. These two items address the awareness dimension (focal and subsidiary) related to this type of knowing. In terms of the activity dimension (bodily versus mental) while you are engaged in the mental act of reading, you are focally aware of the markings on the page, but rarely more than subsidiarily aware of the movements of the muscles controlling your eyes (a bodily activity). Tacitness and explicitness in cognition can be described primarily using a combination of the awareness and activity dimensions.

As we focus upon any focal object (again see Figure 1), whether it be attending to some physical task like raking up leaves or making a difficult decision, we rely upon subsidiary clues. In the instance where the raking up of leaves is our focus, we are only subsidiarily aware of our relationship with the rake. The rake becomes, to a certain extent, part of the human body and experience through its use as hand grips wooden handle, and the sense of soil and grass and leaves are transmitted by vibrations up through the handle, and so on. A coherent pattern of the entire experience, represented by the darkened oval in Figure 1, is only possible through the integration of focal and subsidiary awareness (Gelwick, 1977: 71). Thus, we discern pattern only in relation to the simultaneous focus upon task, decision, or some other aspect of life while relying upon those subsidiary clues. A change in our use of the rake to grab something from a tree or dig channels in a Japanese rock garden changes the way we make meaning of and understand that rake.

While it may be obvious that any physical activity takes a certain amount of mental activity, that any mental activity requires some corresponding physical activity may not be so obvious. For example, the extreme case of sitting still and thinking, though it looks like non-activity, requires physical exertion to maintain stability. Sitting in one place for too

long gets uncomfortable and the physical effort of "just thinking" increases. No matter how pure the physical or mental activity seem, such activities will necessarily and automatically include the other. This is why the framework assumes reciprocity and integration between bodily and conceptual action. These dimensions are central to the human experience and must impact human knowing. This aspect of Polanyi's personal knowledge readily identifies the human element in the act of knowing and acknowledges that the "mind-body reality constitutes a unique mode of existence in the world as we know it" (Gill, 2000: 38).

To summarize, tacit knowing is accomplished through a process Polanyi calls indwelling or "immersing oneself in the particulars of subsidiary awareness by means of embodied activity until these particulars come together as a meaningful whole in an 'integrative act.' When this act takes place, the knowing agent interiorizes the holistic Gestalt, or locus of meaning, and thus can be said to be indwelt by it" (Gill, 2000: 52). This effectively links the above assumptions to the framework and explains the bond between elements within the framework, which means we can now use the framework in an example.

2.4 Examining a Mysterious Face.

Polanyi states that we may know the face of a friend and even pick that face out among a crowd of a million faces. But we still may not be able to describe how we go about doing this (Polanyi, 1966: 4). Thus our long-term familiarity with a face apparently allows us to understand something about it. Yet what that is largely remains a mystery. Thankfully, our inability to explain does not hinder our ability to effectively use what must be a rather large body of tacit knowledge.

The recognition mystery is assumedly true with a famous face as well. The face of Leonardo da Vinci's Mona Lisa, for example, is by many accounts the most widely recognized face ever (Storey, 1980: 5; Kurtz, 1987: 2; Gombrich, 1995: 300). What is it about her face that supports its widespread recognition? Can you list specific items? That is, can you explicitly state what it is about her face that you recognize as distinct from other faces? Is there something about her coloring or is it some other feature? Maybe it is a combination of things, rather than isolated features, that you actually notice. If so, what is this combination? Do you think your list of explicit terms will be similar to others given the same task? It soon becomes evident that describing even this bit of tacit knowledge explicitly is a chore of considerable size.

Perhaps the introduction of a puzzle restricted to but one aspect of the Mona Lisa's face will simplify things - especially since explicit solutions to the puzzle already exist.² It seems that because her facial expression is hard to determine it is hard to tell whether she is smiling or whether she is not (Gardner, 1986: 604). "She seems to change before our eyes and to look a little different every time we come back to her...sometimes she seems to mock at us, and then again we seem to catch something like sadness in her smile" (Gombrich, 1995: 300). Different groups (e.g., artist, art historian, scientist) have provided what seem like reasonable explanations to this problem. I have provided some of their responses to this dilemma and discuss these in terms of the tacit knowing framework.

² I also recommend having a good copy of the portrait close by as it will add to the experience and allow you to scrutinize the mystery for yourself.

The first type of response comes from the artist-technician's perspective and is highly skill and process-oriented. In describing the smile, for example, much attention is paid to the 'sfumato' effect - Leonardo's own invention, which consists of blurring outlines and employing mellow colors that allow a comingling of form (Gombrich, 1995: 303). The sfumato technique used on the Mona Lisa, when examined under X-ray, reveals innumerable applications of thin, superimposed layers of glaze. This emphasizes the unparalleled dexterity and patience demanded from the artist to skillfully bring about the effect (Bramly, 1996: 11). From the artist's perspective the use of chiaroscuro, the arrangement and contrast of dissimilar qualities like light and dark, is also important in explaining the mystery of the Mona Lisa's smile. This technique, it is said, was often used by Leonardo to intentionally disguise the human psyche (Gardner, 1986: 604; Merriam-Webster's, 1999).

The artist-technician's response also pays close attention to the act of rendering expression, the basis for which rests upon details in the corners of the mouth and eyes (Gombrich, 1995: 303; Bramly, 1996: 68-69). According to Gombrich, the mystery of the smile is in large part explained by indistinctness in these details, such that we can never pin down the Mona Lisa's mood (1995). This perspective, then, is concerned with the procedures and prerequisites skills required to produce the ambiguity of the "smile."

The historian's perspective, on the other hand, is less practice-oriented and more concerned with context. Explanation here seems to center upon Leonardo's role as artistic pioneer in 15th century Europe, or his distinct set of experiences and idiosyncratic talent. For example, Leonardo by his own account painstakingly dissected at least thirty cadavers. This is suggested by the historian to be responsible for Leonardo's advanced understanding of complex facial muscles and, consequentially, a possible reason for the enigmatic smile (Kurtz, 1987: 133). Bramly, on the other hand, suggests that the smile is such a mystery due to Leonardo's practice of cataloguing facial features one by one, a system much like the Bertillon system used by police sketch artists today (1996: 19).

Other historian-based responses focus upon a societal interpretation of the art. For example, Gardner suggests that the romantic nineteenth century may have made too much of the enigma of the "smile" in the first place (1986: 604) while Bramly points out that the Mona Lisa's fame only really began in 1830, and exerted no great fascination with generations prior to that point (1996: 62). The implication almost seems to be that the mystery of the smile is an artifact of social construction. From the historian's perspective, then, the effect of ambiguity is a result of Leonardo's pioneering role in history, his development of idiosyncratic skill, or society's construction of a mystery where one need not exist.

I found an example of the scientist's perspective from a recent article in the science section of the *New York Times*. According to the article, the answer to Mona Lisa's puzzling smile is best explained by recent work on visual processing including computer-aided manipulations of the Mona Lisa that simulate human physiological processing (Blakeslee, 2000). The author of the article interviewed Harvard neuroscientist Dr. Livingstone who, upon examining the famous image, experienced a sort of flickering sensation. According to Dr. Livingstone, the Mona Lisa's smile comes and goes because of how the human visual system is designed, not because the expression is ambiguous. The central area of the eye (the fovea) is the part that detects color, fine print, and detail while the area peripheral to

the fovea deals with black and white, motion, and shadows. Dr. Livingstone says that whether or not we perceive a smile depends upon where our gaze is focused. When we look at Mona Lisa's eyes we are more apt to believe Mona Lisa is smiling and when we look at her mouth we are more likely to think she is not. This scientific perspective for the enigma, in this case a viewpoint provided by a member of a field of science that focuses on perception and neurology, offers an unsurprisingly physiological explanation.

Although a number of other diverse perspectives and sound explanations exist, I will call your attention to just one final explanation - the psychoanalytical interpretation of the Mona Lisa provided by Dr. Sigmund Freud (1916, 1964). According to Freud, the Mona Lisa's fascinating and puzzling smile was defined on the fabric of Leonardo's dreams which were based upon his childhood experience (1916: 85). This upbringing, among other things, included an overbearing and erotic love from his natural mother that led to oedipal conflict and latent homosexuality (Freud, 1916: 85, 92, 94). Among the many products of his strong and conflicting emotions for his mother is the Mona Lisa's ambiguous smile. The psychoanalytic explanation, unlike the others, is rooted within the psychic interior of the painter Leonardo and explains more the human psychological source of the smile rather than an effect. Freud does touch on why the viewing public might find the smile unreadable, though. According to the psychoanalyst, Leonardo expressed in his art "his most secret psychic feelings hidden even to himself, which powerfully affect outsiders who are strangers to the artist without their being able to state whence this emotivity comes" (1916: 78-79). The psychoanalytic explanation brings its own unique perspective to bear on the mystery that concern the psychic motivation of the painter himself.

When these perspectives are combined, what conclusions can be drawn about the Mona Lisa? What do we know exactly about her mysterious smile? Are we even sure she has a smile, or are we just as confused as before? Representatives from the above groups certainly do not appear to agree on a conclusion. Nor, does it appear, do they pull from the same body of evidence. Can we even hope to reach a conclusion by drawing upon other perspectives? That is, would viewpoints offered by representative art critic, marketing specialist, professional printer and poet add something to our knowledge or would they serve to further confuse the issue?

Thankfully, my purpose has been to introduce the functionality of the framework and Polanyi's theory, and that these four perspectives look at the same phenomenon in different ways provides a nice test of the framework's utility. Conclusions supporting "evidence" by each representative group are listed in the first and second columns in Figure 2, respectively. These are used below to discuss tacit and explicit knowledge and, especially, focal and subsidiary awareness. The third column pertains to the apparent emphasis given by each perspective. Each emphasis has the potential to enrich our understanding of the Mona Lisa phenomenon but there are even greater implications for our discussion of explicit and tacit knowing. Discussion of the third column underscores the value potential of each viewpoint for each of the other groups and thinking that gets in the way of realizing that potential.

2.4.1 A focal and subsidiary look at the enigma.

A major assumption of tacit knowing theory is that all explicit knowledge emanates from our tacit understanding of things, what diSessa refers to as "machine under the façade" (1994: 51). In the above case, whether individuals were assigned to the task or came to it on their own, they all committed to explaining the mystery of Mona Lisa's smile and, in so doing, acknowledged there was a mystery to be solved. The identification of this or any problem, the motivation to attend to it, and the commitment to continue putting energy into its resolution all derive from a tacit understanding that a mystery does indeed exist (that something is happening) in the first place.

Insert Figure 2 about here

Each of the individuals in each of the representative groups at least shared this tacit knowledge and began their investigations with the same focal object, i.e., what is it with the Mona Lisa's smile? What they did not share, however, was a congruent set of subsidiary clues. This led to differences in that integration between focal and subsidiary awareness and variation in their respectively arrived at patterns of coherence. Each group came to the meaning of the mystery differently and ultimately their understanding diverged. This deviation in understanding sometimes manifest itself in a shared explicit language that differed in meaning and sometimes resulted in the the use or creation of explicit vocabulary that was altogether different. This explains why the neurologist says the smile is not ambiguous, the artist says it is, and the historian says the whole mystery was overblown beginning in the nineteenth century. That their conclusions contradict one another, however, is not so worrisky as the sense of finality that these conclusions appear to convey. Mixed with the high levels of contentment, faith, and rationality within any given field such decisiveness potentially stunts exploration and learning. Each group housing each perspective possesses an internal homogeneity in its tacit and explicit knowledge that will potentially limit its understanding of and undermine the legitimacy of each of the other perspectives.

2.4.2 The enigma and a look at explicit clues.

The attention to a focal object, however, has brought these very diverse groups together at least in their interest in the same phenomenon. This means that while individuals across groups possess some idiosyncratic tacit knowledge they also possess some common tacit knowledge. This should result in some commonalities in their explicit expression of knowledge, especially between the painter and the art historian groups given the overlap in their training, and the bodies of traditional or inherited explicit knowledge they share.

What about the commonalities in the psychoanalytic and the artist-technician perspectives, though, or the similarities between neurophysiologist and the artist-technician perspectives? The Freudian examination and explanation of Mona Lisa's smile focuses on the early development of the artist and its effect on his art. The result of the Freudian perspective in our examination of the Mona Lisa (see column three in Figure 2) is a deeper examination of the linkages between Leonardo's past and present as well as an increased attention toward his interior life. Although psychology has generally informed the artist-technician perspective and has influenced the art in general, it is interesting that dialogue on Mona Lisa's mysterious smile in the respected art materials I reviewed in this article should so

superficially represent the psychological perspective by focusing so heavily on psychoanalysis and neglecting other psychological viewpoints. There are, of course, many potential linkages between the foci of each perspective and opportunities to inform each perspective. This is true in the above case focusing on the Mona Lisa riddle and in other areas of their work as well.

A comparison of the conclusions each group makes is enlightening in and of itself. The tacit knowing framework, however, goes further in pointing out many prospective linkages between those conclusions by drawing upon an examination of focal and subsidiary awareness and other dimensions of the knowing experience to link the tacit with the explicit. Explicit knowledge may actually lock in commitment to a perspective that will lead to a restricted set of conclusions. For example, the term *chiaroscuro* is generally used to refer to contrast between light and shadow, but it can refer to contrast of a deeper variety. In Leonardo's portrait of the Mona Lisa, *chiaroscuro* also refers to a contrast between a wild and fantastic landscape and the Mona Lisa's composed expression and posture (Storey, 1980: 14; Gombrich, 1995: 303). A hypothesis forwarded by art historians is that this *chiaroscuro* also adds to the conflict the viewer experiences with the Mona Lisa and her smile. Only a neurophysiologist who also possessed a deeper understanding of the *chiaroscuro* concept (e.g., a broader definition, greater experience with the concept) would successfully transfer some of that which was useful from that explicit and typically art-related term. This points to the caveat that even the apparently explicit has tacit roots that affect its transfer.

Two important observations deserve highlighting. First, even explicit items are rooted in tacit understanding so there is always more going on that meets the eye. One implication is that imitation and knowledge transfer may be more complex than previously thought. Two, even tacit knowledge is likely to generate some explicit evidence that helps to reveal that tacit knowledge in some way. Knowledge transfer should be more effective between individuals or groups that share similar bodies of tacit knowledge as well as similar sets of explicit clues. A better look at the relationship of tacit and explicit knowledge in the setting of a familiar business focus, that of sustained competitive advantage, identifies some of the other costs and benefits as well. These implications, though, will be central to our strategy discussion that follows.

3. THE RESOURCE-BASED VIEW, A PARADOX AND THE TACIT KNOWING FRAMEWORK

The resource-based view maintains that it is a firm's heterogeneous bundle of resources and the stability of that heterogeneity over time that lead to sustained competitive advantage (Penrose, 1959; Barney, 1986b; Dierickx & Cool, 1989). This requires that firms implement strategies that exploit their internal strengths in response to environmental opportunity, while neutralizing external threats and avoiding internal weaknesses. A firm's sustained success, therefore, depends upon its wise utilization of its heterogeneous and immobile resources.

Barney has suggested that such firm resources may be identified by their value, rareness, imitability, substitutability (Barney, 1991: 101). Briefly defined, a firm resource is valuable when it "exploits opportunities and/or neutralizes threats in a firm's environment" (p. 105).

A firm resource is rare when it is not common among a firm's current and potential competitors. A firm resource is imperfectly imitable when links between a firm and its resources can be characterized by a dependence upon unique historical conditions and geographic or national advantages (Ricardo, 1817/1965; Lippman & Rumelt, 1982; Arthur, 1994). A firm resource may also owe its imperfect imitability to its causally ambiguous or socially complex nature (Lippman & Rumelt, 1982; Rumelt, 1984; Dierickx & Cool, 1989; Reed & DeFillipi, 1990). A firm resource or bundle of resources, even when rare and inimitable, are substitutable when resources or resource bundles from other firms may be used to implement the same strategies. Thus, a firm resource or resource bundle must not have similar resource or strategic outcome substitutes to provide a firm with sustained competitive advantage (Barney, 1991: 111). Given these different definitions and conditions, resources possessed by a firm are likely to confer sustained competitive advantage only when they are valuable, rare, inimitable, and non-substitutable.

I discuss a concern regarding knowledge and one of the above indicators of its sustainability in the following section. I then use the framework to examine the knowledge problem in much the same way as it was applied to the Mona Lisa's mysterious smile. The application of the framework to knowledge's sustainability issues - in value, rareness, inimitability and non-substitutability terms - is not meant to be exhaustive, but does provide a good example of the framework applied to one specific strategic issue. The framework is also used to develop a practice-based discussion that includes details on some of the most relevant propositions.

3.1 A Paradox with Tacit and Explicit Knowledge.

One of the perplexing questions surrounding organizational knowledge, if you consider it to be a firm resource, surrounds its tangible and intangible aspects. Specifically, how can explicit knowing be a source of sustained competitive advantage when organizational knowledge at its most explicit appears to be highly imitable? Explicit knowledge would appear to be a highly visible and likely target for appropriation by competitors. The explicit knowledge of a firm represented by its operational language and procedures, the logic embedded in its systems and certain human behaviors could all be duplicated.

Related to this, how can tacit knowing be a source of sustained competitive advantage when organization knowledge at its most tacit certainly appears rare and inimitable, but does not appear conducive to transfer within the organization? Tacit knowledge would appear quite safe from theft or imitation by competitors, but it would also then appear quite difficult to successfully replicate even within the organization. Indeed, one of the major dilemmas intrinsic to a strict dichotomous view of knowledge - where tacit and explicit are two static ends of a *descriptive* continuum - is their mutual exclusivity and apparent inability to separately generate and sustain competitive advantage. A strength of the tacit knowing model, discussed in more detail in the next section, is the dynamic tension assumed to exist between tacit and explicit knowledge. For one thing, it allows its user to reframe sustainability problems currently assumed to exist for both explicit and tacit knowledge, providing its user with deeper insights into knowledge issues. These types of insights can be used to create the types of propositions that are discussed in the next section.

3.2 Tacit and Explicit Knowledge and RBV.

This section's discussion hinges upon details relevant to the tacit and explicit knowledge paradox, framework-related insights and sample propositions (see Figure 3). Although we will focus mostly on the two issues mentioned above - explicit knowledge's apparent imitability and tacit knowledge's apparent non-transferability - the table has dimensionality beyond these two areas of focus. Indeed, both related and tangential foci are suggested by the table that are worthy of more detailed discussion and analysis, but space constraints do not permit such elaboration here. Discussion within this section will therefore be limited to the shaded row (imitability) of Figure 3. However, this should suffice to illustrate the value of tacit knowing theory to knowledge's sustained competitive advantage.

Insert Figure 3 about here

Remember that the crux of one of our paradoxes is that which is easily communicated - like formulas found in things like equipment or documents, or product specifications, patents, routines, and standard operating procedures (Nonaka & Takeuchi, 1995; Choo, 1998: 112) - is also easily appropriable. That which is not formally expressed and is not codified, on the other hand, is usually difficult to communicate and even more difficult to share (Choo, 1998: 111).

Beginning at the intersection of the imitability row and column *A*, the furthest column left, we look at what I have labeled common assumptions about explicit knowing. These assumptions relate to attitudes or beliefs toward explicit knowledge as being characterized as easy to understand which is sufficient if we treat explicit knowledge as a simple label. There is a danger, however, that doing so understates the complexity of explicit knowledge, which is one insight offered by using tacit knowing theory. This brings us to the column *B*, row three intersection. Ignoring explicit knowledge's relationship to tacit knowledge may lead to the belief that explicit knowledge is perfectly imitable and could potentially lead firm members to adopt a damaging sense of security.

The other extreme (see row three, columns *C* and *D*) involves the assumption that tacit knowledge by definition is difficult to imitate, which leads to the second paradox concerning the difficulty firms are expected to experience when sharing tacit knowledge with chosen others. This difficulty would manifest itself in a number of ways including a slower transfer of tacit knowledge. One solution commonly forwarded in response to this particular paradox is to make all tacit knowledge explicit. According to tacit knowing theory though, it is impossible to make all tacit knowledge explicit and such a proposition is neither necessary nor desirable. Transforming tacit knowledge into explicit form runs the risk of changing, possibly even degrading, that tacit knowledge (Prosch, 1986: 210).

One way this may happen is that the explicit may too narrowly define that to which we attend which is, in part, both a benefit of and danger of specialization. For example, a health columnist for *The Wall Street Journal* recently reported receiving, after being sent to eight different back specialists, a total of eight separate diagnoses³ (Gubernick, 2000). It

³ Among these were sacroiliacitis, nerve radiculitis, tension myositis syndrome and stress.

may be that medical training's focus upon a highly explicit body of knowledge and strong reliance upon tradition necessitates a type of learning, including concentrated memorization of terminology and procedure, that opens up a specific range of options while closing down a number of others. Many types of training combine the digestion of an explicit body of knowledge with the abandonment, to some degree, of creativity and exploration. When this happens, an explicit body of knowledge actually seems to reinforce certain frames of tacit knowledge while simultaneously impeding others.

Were the specialists in the above example to communicate with one-another they might be inclined to consider alternative diagnoses out of professional courtesy. However, coming to some agreement would probably take some doing given the diverse professional orientation of the group (e.g., osteopath, neurologist, physiatrist, chiropractor and acupuncturist). Moreover, it is somewhat telling that there is very little cross-association between these different groups. Relating this back to our discussion of the tacit knowing framework and imitability, some firm resources serve to tie tacit and explicit knowledge together. These resources include intangible human capital, that incorporates the time and energy invested in education (Becker, 1964/1975; Coff, 1999), as well as equipment, standard operating procedures and the interactions between them. This leads to the related proposition that the appropriation of explicit knowledge, whether it be overt or covert, is more likely to lead to success between entities sharing similar tacit knowing than between entities that do not (Proposition 6, Figure 3). For example, communication between two neurologists probably benefits from greater understanding and reliance upon both a common tacit understanding and use of explicit terminology. That communication is also probably facilitated by a pre-existing commonality in the doctors' tacit knowledge (which relates to Proposition 8) and should actually be expected to speed the transfer of knowledge between the two doctors in some instances.

In contrast, the above communication is probably less likely between a neurologist and a homeopath. Should the neurologist attempt to acquire even relatively simple (i.e., explicit) homopathic knowledge, it is conceivable that even the most explicit knowledge would likely change as a function of the neurologist's pre-existing explicit and tacit knowledge (Proposition 7). The neurologist is likely, that is, to bring past knowledge and experience to bear on new information. As was the case with the Mona Lisa, an initial focus can rapidly change as a result of past experience, causing very different interpretations to emerge out of the collision between familiar and unfamiliar information.

The benefit of employing tacit knowing theory is that we are prompted to ask questions that potentially reveal a complexity in the types of interactions described above. These questions are quite different than those generated by a more dichotomous view of tacit and explicit and lead to very different conclusions or, in some cases, lead to a suspension of conclusion that sanctions the quest for greater understanding. This has definite implications for the firm trying to gain or maintain a sustainable competitive advantage and for the treatment of knowledge in general.

4. IMPLICATIONS

The resource-based view advocates the thoughtful acquisition of resources such that they will optimally mix with a firm's current resource stock. Long-term competitive value, after

all, is more likely to accrue to the firm that is expert in this task. This means, however, that such a firm must be able to take an accurate introspective stock and marry that with a precise interpretation made of the environment (or at least do this better than other firms). This, in turn, primarily depends upon how effectively an organization manages one of its primary resources - its knowledge.

Sharing knowledge, for example, is not a costless proposition even within a firm. This activity may require pulling people off of certain activities to share what they know. Meanwhile, some individuals have to stop what they are doing to 'learn' what is being 'taught' and others either pick up the slack or certain work does not get done. In fact any number of accounting or opportunity costs could factor in here. At least as important, however, are factors concerning the viability of such knowledge sharing. This will depend, in large part, upon an understanding of the knowledge congruence between the groups in both tacit and explicit terms. A more detailed analysis of the tacit and explicit characteristics of each group should lead to a better understanding of some of the barriers to such sharing and, thus, a better understanding of some of the costs. It may be that terminology used by two separate units in a organization use what appears to be identical language. A closer examination, however, should reveal some hidden differences that influence the decision's outcome.

The impact of tacit and explicit knowledge on firm-to-firm knowledge sharing is also important. For example, while multiple firms within an industry may attend to the same focus, the subsidiary clues they use both prior to and during integration and pattern formation are unlikely to be the same when their histories (Arthur, 1989; Arthur, 1994; Schilling, 1998), corporate cultures (Smircich, 1983; Hatch, 1993), and senses of firm identity (Gioia, Schultz & Corley, 2000) differ. Other inertial forces may also play a part in the formation of heterogeneous firm knowledge (Hannan & Freeman, 1984; Miller, 1990). Derived meaning between firms is also likely to differ depending upon the quality of firm socialization (Blau, 1999; Albert, 2000) and the quality and types of mentorship that firm maintains (Turban & Dougherty, 1994; Tepper, 1995; Ragins, 1997). The agglomeration of past shared meanings and sense-making within an organization are likely to influence or support the shared comprehension of new tacit-explicit links. Thus, the mere fact that past exchanges have taken place that link explicit and tacit understanding more tightly within an organization than between organizations creates an atmosphere where the transfer and replication of such knowledge may more efficiently and effectively take place. That is, a firm's past experience with tacit knowing allows it to better communicate its tacit knowledge in a form that is more rapidly and accurately comprehensible. This would give a firm that is host to such valuable tacit knowledge a clear advantage over firms attempting to appropriate that knowledge or develop substitutes for that knowledge.

Lastly, for the specific firm looking at its knowledge resources, it becomes increasingly important to examine the efficiency and effectiveness of explicit and tacit knowledge linkages, their number and strength, and their complementarity or congruence with firm strategy. The firm that is more skilled at introspection, i.e., better understands how its explicit and tacit knowledge interrelate, will better understand its important strengths and weaknesses. If the resource-based view is correct, such introspection is an essential precursor to resource acquisition and integration that will lead to greater success.

Of course the big questions raised by the framework involve connections between tacit and explicit knowledge including those connections on and between the individual, group, and societal levels. What, for instance, is the strength and quality of those connections? When are such connections needed and when do they impede things like knowledge transfer or knowledge creation? In what areas should tacit knowledge remain tacit and when should it be made explicit? How can such knowledge be cultivated? Can a firm do anything to protect the knowledge it currently possesses against unforeseen damage to that knowledge? It may be that certain redundancies in vital areas are necessary and desirable to hedge against knowledge 'contamination'.

Many of these questions are of course empirical in nature and point to future research opportunities. Given the complexity of the knowledge phenomenon, there is still much need for a variety of investigative approaches including rigorous qualitative, quantitative, and mixed approaches. Research into knowledge specifically appears essential to our better understanding of how resources may be adequately combined, especially given the increased human intellectual involvement in modern day delivery of both products and services. The way in which our tacit and explicit understanding interacts on a personal and social level may point to the acquisition of certain resources and the abandonment of others. It also possesses great potential for informing the make or buy decision frequently posed to management.

While addressing the above issues, perhaps even before addressing those issues, more work needs to be done to better understand tacit and explicit knowledge. For example, when does that which is apparently explicit become highly complex? What appears to affect that complexity? Remember that tacit and explicit knowledge are assumed to be connected through what Polanyi calls the personal coefficients of knowledge. How do those coefficients influence one-another? How can individual, group, and organizational knowing be better informed? Can the quality of knowledge for each of these levels be improved? It seems as though better introspection or self-knowledge by individuals, groups and organizations would be desirable, and that it would lead to greater efficiency, better understanding of the environment, and a better set of decisions.

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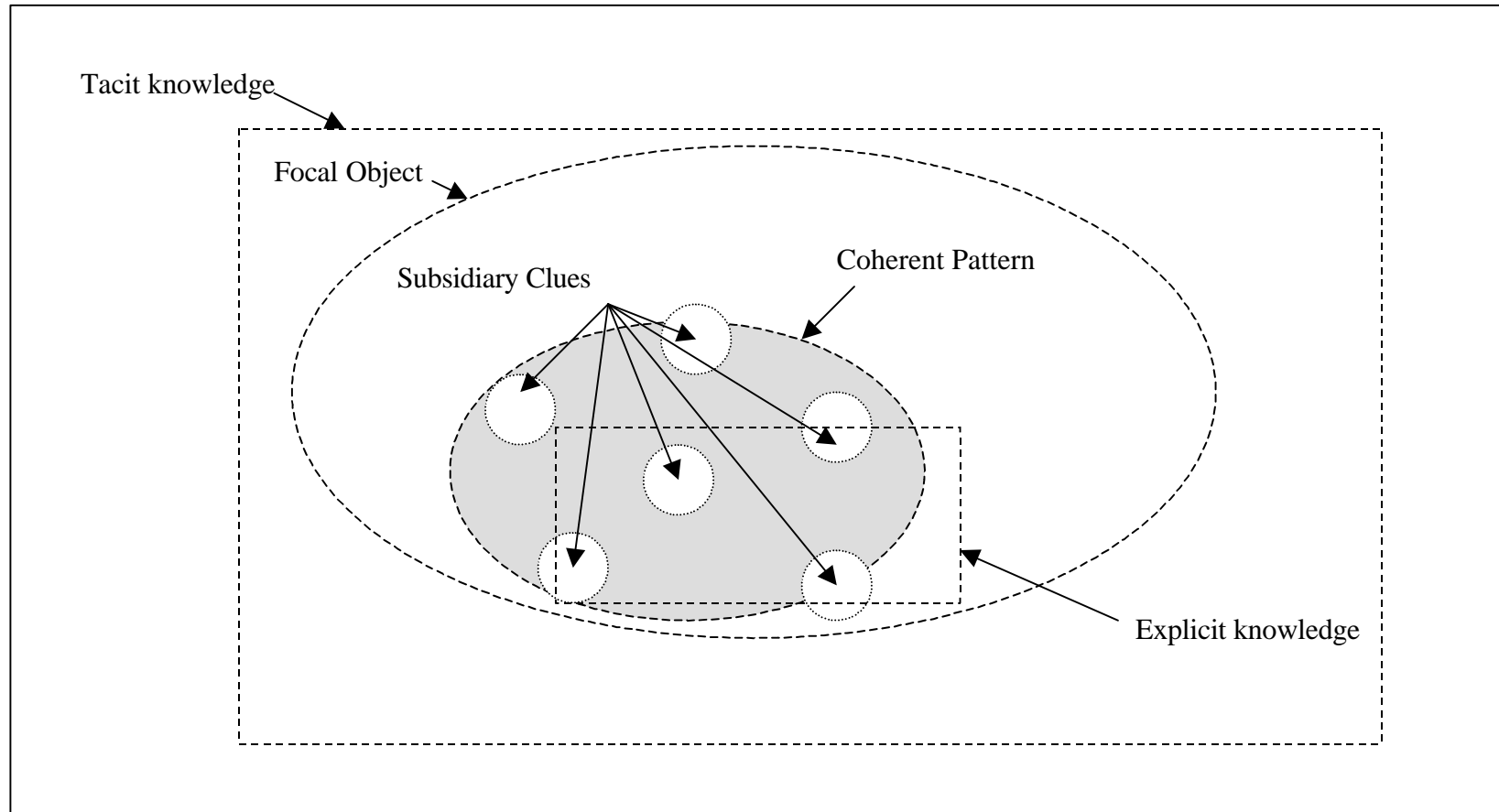
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FIGURE 1
A FRAMEWORK FOR UNDERSTANDING TACIT KNOWING^a

Knowledge



^a Dotted lines indicate the ambiguity regarding the separation of entities in the model. The figure depicts neither causal nor linear relationships. Neither relative size nor relative importance are depicted by the framework. Arrows above are used to clarify labeling.

FIGURE 2
CONTRASTING VIEWS EXPLAINING THE ENIGMA AND NEW ATTENDANT FOCI

The Knower	Answering the Riddle	Key to Understanding	Some Suggested Resulting Foci
1. The painter	Smile painted to be ambiguous.	Style - chiaroscuro & sfumato. Details in composing expression - attention to eye and mouth. Attention to procedure	Communication between artist and public. Manipulation of audience. Exploration. Skill development.
2. The historian	Mystery behind smile artificial. Advance in knowledge made smile possible.	Attention to historical context. Societal inventions. Ebb and flow of fads and other popular influences. Artist's personal history as engineer, interest in science, renaissance man, etc.	Focus on societal and historical influences. Look at advances in science. Examine consequences of discovery.
3. The neurophysiologist	Smile not ambiguous at all. Perception of the viewer to blame.	Attention to the sense organs of the viewer. Reaction to representations of shade and light.	Physiological look at the viewing public. Examine physical limitations of the public. Examine the interface between man and environment.
4. The psychoanalyst	Confusing smile a reflection of love & hate conflict toward mother. Homosexuality latent in artist.	Attention to past personal history of the artist. Dreams link artist to his past. Family history, childhood, parental relations, etc. Current behavior gives clues to past events.	Link present to past of individual. Link the internal private (and sometime unknown) world of the individual to the external world. Look at the influence the psche exerts on action.

FIGURE 3
RARENESS, VALUE, INIMITABILITY AND NONSUBSTITUTABILITY PARADOX OF KNOWLEDGE RE-EXAMINED
USING THE TACIT KNOWING FRAMEWORK

Indicators of Sustained Competitive Advantage	Explicit Knowing - EK		Tacit Knowing - TK		Practical Implications and Sample Propositions
	Some Common Assumptions	Framework's Insight	Some Common Assumptions	Framework's Insight	
	A	B	C	D	
1. Value Allows exploitation of opportunities and/or neutralization of threats?	<ul style="list-style-type: none"> Unclear value - EK a commodity 	<ul style="list-style-type: none"> EK contains clues to types & sources of TK EK tied to TK and influences firm perception, framing 	<ul style="list-style-type: none"> The presence of TK is itself value-adding TK is the key source of value 	<ul style="list-style-type: none"> TK may erode or add value TK's source & frequency of use important TK/EK link related to value 	P1. Within-firm TK/EK link quality is positively related to speed of value identification P2. Within-firm TK/EK link quality is positively related to magnitude of value capture P3. Within-firm TK use is positively related to the quantity and quality of EK
2. Rareness Uncommon among current and potential competitors?	<ul style="list-style-type: none"> Not rare because of easy duplication 	<ul style="list-style-type: none"> EK's simplicity is deceptive Replicability overstated 	<ul style="list-style-type: none"> Most TK is a source of scarcity 	<ul style="list-style-type: none"> Rareness of TK may isolate firms, groups and indiv's TK rareness may erode value 	P4. Rareness is more a function of a firm-customer TK/EK congruence than similarity in EK terms between firms P5. High regulation or industry standardization will be positively related to between-firm EK congruence
3. Inimitability Is this dependent upon the link between a firm and its resources?	<ul style="list-style-type: none"> Not causally ambiguous Not complex History and locus not relevant 	<ul style="list-style-type: none"> EK imperfectly imitable Can provide false sense of security Inimitability based upon existing TK 	<ul style="list-style-type: none"> By definition difficult to imitate Make TK explicit to share in the firm Slow internal transfer 	<ul style="list-style-type: none"> Some firm resources serve to tie TK and EK together Imitation may or may not be wise TK may speed or enhance quality of transfer 	P6. EK appropriation success is positively related to TK congruence between firms. P7. Appropriated EK will change as a function of pre-existing firm TK P8. EK appropriability is determined by existing TK P9. Within-firm TK/EK link quality is positively related to its merger and acquisition success
4. Non-substitutability Subject to strategic equifinality?	<ul style="list-style-type: none"> Easy to substitute May be added to any resource with relative ease 	<ul style="list-style-type: none"> EK's strategic link ambiguous EK gives clues of complex structures 	<ul style="list-style-type: none"> Equifinality less probable w/ TK Unclear barriers to substitution 	<ul style="list-style-type: none"> TK shared between firm & others explain non-substitutability 	P10. Non-substitutability is positively related to the strength of within-firm TK/EK links P11. Non-substitutability is positively related to the strength of the link between firm and customer TK/EK