Tacit Knowledge and the Economic Geography of Context
or
The Undefinable Tacitness of Being (There)

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INTRODUCTION

It has now become commonplace to refer to the current period of capitalist development as the era of the 'knowledge-based' (OECD, 1996) or 'learning' (Lundvall and Johnson, 1994) economy. No matter which label one prefers, the production, acquisition, absorption, reproduction and dissemination of knowledge is seen by many as the fundamental characteristic of contemporary competitive dynamics. Long before this parlance became popular, scholars had expressed a deep interest in distinguishing between different types of knowledge. Philosophers of knowledge such as Ryle (1949) and Polanyi (1958; 1966) anticipated later developments in social constructivist thought by enunciating what was for them a crucial distinction between knowledge that could be effectively expressed using symbolic forms of representation – explicit or codified -- and other forms of knowledge which defied such representation – tacit knowledge (see Reber, 1995; Barbiero, n.d.).

Within the field of innovation studies and technological change, and especially since the publication of Nonaka and Takeuchi's The Knowledge-Creating Company (1995), the distinction between tacit and codified knowledge has been accorded great significance. However, in characteristically prescient fashion Nelson and Winter (1982) in their classic work had already made extensive use of the concept, which informed their analysis of organizational routines within an evolutionary perspective on technological change. In drawing attention to this concept, these authors helped revive widespread interest in the earlier work of Michael Polanyi, to the point where tacit knowledge has come to be recognized as a central component of the learning economy, and a key to innovation and value creation. Moreover, tacit knowledge is also acknowledged as a prime determinant of the geography of innovative activity, since its central role in the process of learning-through-interacting tends to reinforce the local over the global. For a growing number of scholars, this explains the perpetuation and deepening of geographical concentration in a world of expanding markets, weakening borders, and ever cheaper and more pervasive communication technologies.

Recently, tacit knowledge has received considerable attention within the field of industrial economics (see for example Cowan et al., 2001; Johnson and Lundvall, 2001), where a process of critical re-examination has begun. Considering the somewhat loose and indiscriminate way in which the term has come to be applied, and in light of the generally superficial understanding of the origins of tacit knowledge prevalent in the literature, this recent debate is a welcome development. This paper provides a further contribution to this project of reproblematization by offering a critical analysis of the prevailing implicit and explicit economic geographies of tacit knowledge. It proceeds in four sections. The following section reviews the standard definitions of tacit knowledge and discusses the reasons for its heightened importance in recent scholarship on economic change. The second section further unpacks the concept of tacit knowledge by arguing that there are in fact not one but three distinct 'tacit knowledge problems' implicit in the literature on innovation and knowledge management. Moreover, not all of these problems are 'new' but are indeed fundamental to capitalism. Next, we consider competing arguments within the literature concerning the extent to which these problems can be overcome. Finally, we conclude with a fundamental reassessment of the nature and origins of tacit knowledge, in which the role and nature of context are much more fully examined. Here our aim is to recentre the analysis of tacitness away from its predominantly cognitive or

'psychomotor' foundations, and to reconstruct the concept from an institutional perspective.

A. TACIT KNOWLEDGE: WHAT IS IT AND WHY DOES IT MATTER?

In his classic work The Tacit Dimension, Michael Polanyi's felicitous phrase "we can know more than we can tell," (1966, p. 4) lies at the heart of his distinction between tacit and explicit or codified knowledge. Polanyi's underlying motivation was to argue that 'scientific' knowledge is produced by individuals who imbue their search for new knowledge with deeply personal content.[1] In other words, the knowledge of scientists is not fully reducible to a clearly articulated set of axioms, rules, algorithms, and statements (Sveiby, 1997). The tacit dimension of knowledge exists in the background of our consciousness, enabling us to focus our conscious attention on specific tasks and problems. As Nelson and Winter (1982) put it, "To be able to do something, and at the same time be unable to explain how it is done, is more than a logical possibility – it is a common situation" (p. 76). Hence, one can distinguish between explicit knowledge as 'know-that' and tacit knowledge as 'know-how'.

Perhaps the easiest way to define tacit knowledge is by specifying what it is not. Hence, the paradigmatic examples used to illustrate this idea, whether in Polanyi's own work or elsewhere, tend to focus on the performance of skills such as swimming, landing an airplane, identifying a person's face, riding a bicycle, or making bread. In each case, the successful performance of a skill depends on "the observance of a set of rules which are not known as such to the person following them" (Polanyi, 1958, p. 49) – i.e. knowledge that is "imperfectly accessible to conscious thought" (Nelson and Winter, 1982, p. 79). When the skilled performer attempts to describe or explain their performance to an unskilled pupil, symbolic forms of communication such as spoken or written words cannot convey all of the knowledge necessary for successful execution. Even pictures, though helpful, will not fully suffice.

In other words, the tacit component of the knowledge required for successful performance of a skill is that which defies codification or articulation – either because the performer herself is not fully conscious of all the 'secrets' of successful performance or because the codes of language are not well enough developed to permit explication. In such cases, the best way to convey such knowledge is through demonstration and experience, such as in the classic master-apprentice relationship in which observation, imitation, practice, and correction are employed in the learning process (Polanyi, 1966; Nonaka, 1991). Hence, because knowledge acquisition occurs through the process of doing, this approach is well captured in the concept of learning by doing (Arrow, 1962).

In this literature, the relationship between tacit knowledge and context is a reflexive one, since tacit knowledge both defines, and is defined by, social context. On the one hand, tacit knowledge is an essential complement to explicit knowledge, in the sense that it supports the

[1] "The declared aim of modern science is to establish a strictly detached, objective knowledge. ... But suppose that tacit thought forms an indispensable part of all knowledge, then the ideal of eliminating all personal elements of knowledge would, in effect, aim at the destruction of all knowledge. The ideal of exact science would turn out to be fundamentally misleading and possibly a source of devastating fallacies" (Polanyi, 1966, p. 11).

acquisition and transmission of explicit knowledge through tacitly held constructs such as the rules enabling speech, reading and writing. At the same time, tacit knowledge can only be shared effectively between two or more people when they also share a common social context: shared values, language and culture.

Having reviewed the definition of tacit knowledge, an obvious question is: why has this concept received so much attention in recent times? Why does it matter to scholars of innovation and regional economic change? One compelling answer to this question arises from the competence-based view of the firm and the nature of modern competition (Penrose, 1959; Kay, 1993). The idea is that, in a competitive era in which success depends increasingly upon the ability to produce new or improved products and processes, tacit knowledge constitutes the most important basis for innovation-based value creation. As Maskell and Malmberg (1999, p. 172) have recently put it, when everyone has relatively easy access to explicit/codified knowledge, the creation of unique capabilities and products depends on the production and use of tacit knowledge

> Though often overlooked, a logical and interesting consequence of the present development towards a global economy is that the more easily codifiable (tradable) knowledge can be accessed, the more crucial does tacit knowledge become for sustaining or enhancing the competitive position of the firm. ... In other words, one effect of the ongoing globalisation is that many previously localised capabilities and production factors become ubiquities. What is not ubiquified, however, is the non-tradable/non-codified result of knowledge creation – the embedded tacit knowledge that at a given time can only be produced in practice. The fundamental exchange inability of this type of knowledge increases its importance as the internationalisation of markets proceeds.

Implicit in the above quote is another, fundamentally spatial argument: that tacit knowledge is a key determinant of the geography of innovative activity. There are two closely related elements to this argument. The first is alluded to above: that tacit knowledge, because it defies articulation or codification, is difficult to exchange over long distances. Its context-specific nature therefore makes it spatially sticky. The second relates to the changing nature of the innovation process itself and, in particular, the growing importance of socially organized learning processes. The argument here is that innovation has come to be based increasingly on the interactions and knowledge flows between economic entities such as firms (customers, suppliers, competitors), research organizations (universities, other public and private research institutions), and public agencies (technology transfer centres, development agencies). This is fundamental to Lundvall and Johnson's (1994) learning economy thesis, and is especially well reflected in their concept of "learning through interacting". When one combines these two features of the innovation process – the centrality of 'sticky' tacit knowledge and the growing importance of social interaction – it becomes apparent why geography now 'matters' so much. As we shall see below, however, this argument has recently become contested.

B. THREE TACIT KNOWLEDGE PROBLEMS

Since the mid-1990s, the centrality of knowledge, learning and innovativeness to firms' competitive success has come to be more widely appreciated. Over this time a new interest in 'knowledge management' (KM) began to emerge – first in the writing and teaching of business school professors, and shortly thereafter in the business world, as consulting firms recognized a large potential market amongst businesses who would need to improve their knowledge management processes and practices (see for example Leonard, 1995; Prusak, 1997; Sveiby, 1997; Boisot, 1998; Davenport and Prusak, 1999). In fact, so rapidly has this interest grown, that it is no exaggeration to claim that KM has become the big issue in management theory and practice over the past five years. Moreover, for reasons that will soon become apparent, tacit knowledge is central to this process.

The goal of KM, at least as seen from the business perspective, is to create value by accumulating and 'leveraging' intangible (especially knowledge) assets. In order to do this, firms must overcome a number of central obstacles or problems which arise at several different sites or scales: inside the firm (between individual workers or groups of workers), between divisions and branches (local and non-local) within the individual firm, between firms (locally), and between firms separated by substantial distance (as well as regional and national boundaries). While much of this literature (as well as the corresponding interest within economic geography, industrial economics, and innovation studies) focuses on a single problem – can tacit knowledge be transferred, and if so, how and under what circumstances – it is possible to discern at least three separate and distinct tacit knowledge problems, each of which poses a significant challenge to firms. I will argue here that understanding the nature of all three provides us with a stronger foundation for developing a more robust theory of tacit knowledge and its geography.

1. How to produce it

The central assertion arising from the KM literature is that the quality and innovativeness of a firm's products, as well as its production processes, modes of organization and procedures, depend to a very large extent on their tacit knowledge content, which constitute a large part of the firm's unique assets and capabilities. This implicitly raises the question, then, of how firms go about producing tacit knowledge in the first place. This problem has both private and social dimensions. The private dimension focuses on the investments in (individual) human capital – through education and training – necessary to produce capable knowledge workers. If tacit knowledge is embodied knowledge, then well-educated workers – or what Florida (2000) and others have come to call 'talent' – are essential to the production of this important ingredient.

However, this process moves very quickly from the private to the social realm. First, as Howells (2000) and others have pointed out, much of the tacit knowledge produced within organizations arises 'in doing', from the social interaction and collaboration of individual workers within a shared social, organizational and cultural context. Second, as Florida points out, because talented labour is potentially highly mobile, the key challenge for firms (as well as

regions and nations) is not just to produce talent with the right attributes in sufficient quantity, but also to retain it, once produced, as well as to attract it from elsewhere. Florida's empirical work demonstrates that these processes of retention and attraction are actually social processes, in that they rest on the social (and physical-environmental) character of firms, cities and regions. Local quality of life, broadly defined, is the principal determinant of a firm's ability to assemble the one resource most central to the production of tacit knowledge. More specifically, he finds that the single most crucial aspect of this is the presence of a social milieu that accommodates a rich diversity of talent by integrating newcomers, maintaining low barriers to entry into local social and economic systems, and welcoming social difference.[2]

While tacit knowledge is clearly a vital component of the innovation process, it is important not to lose sight of the continuing importance of explicit or codified knowledge and its complementarity to tacit knowledge, as Amin and Cohendet (1999) have recently reminded us. In light of this, the first problem might actually be reconceived in terms of another challenge for individual workers, firms, and regions: to establish the right balance or mix of theoretical (explicit/codified) and practical (tacit) learning. In other words, the ability of workers and firms to absorb tacit and codified knowledge may depend directly on prior investments in research and development, training and the general level of education and skill of the workforce. Without this prior investment, individual workers and firms will likely be poorly prepared for engaging in learning by doing and interacting. Hence, an 'absorptive capacity' (Cohen and Levinthal, 1990) must first be established.

[2] In his econometric modelling of the determinants of growth rates in highly skilled employment across US metropolitan areas, Florida finds that the variable which best captures this effect is a 'gay index'. He interprets this finding as indicating that those places that are the most tolerant and welcoming of social diversity are also the city-regions that have the lowest barriers to entry for newcomers – a finding of some significance to our evolutionary interpretations of the relationship between variety and (local) innovative potential. This general line of argument is also consistent with Saxenian's (1999) recent work on the dynamic role of immigrant entrepreneurs in Silicon Valley.

2. How to find and appropriate it

Particularly for large, multi-divisional and multi-branch firms, a key challenge that has been recognized within the KM literature is how to find and – once located – appropriate tacit knowledge. This arises as a management challenge precisely because of the localized, non-ubiquitous, context-specific nature of tacit knowledge discussed earlier. Hence, it has also emerged as a geographical question at issue when firms are deciding where to locate future new research and production facilities. That is, firms are said to be increasingly keen to invest in those regions where lots of tacit knowledge is produced and shared, whether it be Silicon Valley or Silicon Valley North (the Ottawa region) – those places which have that special something 'in the air'.

Within the KM literature, the processes of search and appropriation are frequently described as acts of 'capture', 'harvest', or 'unlocking'.[3] The effective manager's challenge – indeed, responsibility – is to track down tacit knowledge wherever it may reside in the far reaches of the organization, then to appropriate it for productive use to benefit the firm. A recurring theme here is the problem of transferring tacit knowledge from the individuals who comprise the firm (and jointly produce tacit knowledge), to the larger organization so that it may be more widely exploited (Kogut and Zander, 1992).

This issue alerts us to an important connection between contemporary problems of tacit knowledge and a much older problem inside the firm: one of bridging the gap between conception and execution, and of building recursive loops to allow tacit knowledge acquired during execution by shopfloor workers to feed back to conception by engineers, designers and managers. We can think of this as the 'original tacit knowledge problem,' if you will – one that is as old as capitalism itself. As the 'quality revolution' swept through one manufacturing industry after another during the late 1980s and early 1990s, following the remarkable success of the Japanese model of workplace organization, the issue of how to organize work and the employment relation to promote this flow of tacit knowledge from workers to management was seen as the principal problem for management (Oliver and Wilkinson, 1988). We know from the research on this subject that the ability to appropriate tacit knowledge in the workplace depends, more than anything else, on the social relations surrounding production (Kochan and Osterman, 1994; Wever, 1995). This aspect of tacit knowledge appropriation therefore provides an important clue as to the true nature of 'context', and those characteristics most important to the

[3] One recent text in the field carries the title *Enabling Knowledge Creation: How to Unlock the Mystery of Tacit Knowledge and Release the Power of Innovation* (von Krogh et al., 2000).

successful 'transfer' of tacit knowledge.[4]

Finally, an issue that has received a growing amount of attention within the last few years concerns the question of measurement of knowledge (Sveiby, 1997). While this is relevant to both codified and tacit knowledge, the problem of measurement is especially challenging in the latter case. The KM literature highlights a series of related questions concerning knowledge management in firms: how much have we got and is it enough? Is it the right kind of knowledge? Can we reflect it on our balance sheet? Can we benchmark a region's 'stocks' of knowledge, knowledge infrastructure and 'talent'? Note that the latter is an issue for both firms – in their search for appropriate sites for investment – and regions, whose local leaders may be asking themselves "how do we measure up against the competition"?

This measurement issue is significant for at least two reasons (beyond simply generating lucrative business for KM consultants). First, it demonstrates the growing recognition of the importance of knowledge assets, and especially tacit knowledge, to firms. Second, the acknowledged difficulty in measuring a stock of tacit knowledge underscores how slippery, elusive, context-specific and embedded it actually is. One increasingly common method focuses on the accountant's concept of 'goodwill' – that is, the difference between the book value of a firm's assets and its current valuation on public stock markets (Sveiby, 1997). Intriguing as this methodology may seem, the wild gyrations in market cap values for many knowledge-based firms in recent times suggest that this approach – much like Solow's famous residual – amounts to little more than a "confession of ignorance" (Arrow, 1962).

3. How to reproduce or share it

The third tacit knowledge problem – how to spread it around more widely, once it has been produced, isolated, and appropriated – has received more explicit attention than either of the first two, at least in recent times. While it is an issue of central importance to economic geographers for obvious reasons, it has recently become a concern of overriding importance within the management literature as well as within industrial economics and the innovation systems literature. It can be thought of as a problem of how to promote social learning processes.

This issue presents a special problem for 'distributed organizations' in which different units are situated in different locations separated by long distances. If there is one assertion on which there is widespread agreement, it would be that the transmission or diffusion of tacit knowledge is not straightforward. This is principally because successful sharing depends on close and deep interaction between the parties involved (Lundvall, 1988). However, as we shall

[4] It also supports the argument of Johnson and Lundvall (2001) that power relations might turn out to be an important aspect of our understanding of how tacit knowledge is produced and distributed.

see below, there is considerable disagreement concerning how 'close' should be defined. Some contend that the process, if it works at all, may depend on the conversion of knowledge from its tacit to its explicit form ('externalization,' according to Nonaka and Takeuchi, 1995). Others remain more skeptical about the possibility of this actually being achieved successfully.

Looking more carefully at this issue, it becomes clear that there are really two different problems in one. For the sake of conceptual clarity, it is important to treat these separately – something which is all too often overlooked in the KM literature, in particular. The first problem addresses the 'moment' of innovation (whether of the 'big bang' variety or a more incremental form) and asks: if innovation has become an increasingly social process resting on the production and exchange of tacit knowledge, then how 'close' must those participating in the process be to one another for it to work? And what kinds of proximity matter? Is simple physical proximity sufficient? How important is cultural commonality? Or is organizational or relational proximity the crucial factor?

The second aspect of this problem concerns difficulties in the diffusion of innovations (including what are commonly referred to as 'best practices') throughout a large organization, especially when the innovations must be transmitted across regional and national boundaries as well as cultural and other divides. Not surprisingly, a large proportion of the recent KM literature has focused on this problem. According to Prusak (1997, p. xii), the problem can be stated in the following terms:

> The huge scope of the modern corporation makes an important case for more deliberate knowledge management. ... Geography brings additional challenges: if knowledge is only transferred through proximity and exposure, how long does it take for something that is known in Munich to make it to Michigan?

Although Prusak refers simply to "knowledge" in this quote, it is clear from his discussion that what he has in mind primarily is tacit knowledge. In other words, he supports the argument made by Maskell and Malmberg (1999) that in a world in which access to codified knowledge is becoming ever easier, a firm's ability to produce, access and control tacit knowledge is most important to its competitive success.

However, it is also evident that Prusak sees the third tacit knowledge problem – how to reproduce or share it – as being implicitly bound up closely with the second problem of finding and appropriating tacit knowledge. This dual nature is evident in a quote he reproduces which he attributes to Lew Platt, Chairman of Hewlett-Packard: "'If only HP knew what HP knows, we could be three times more productive!'" (Prusak, 1997, p. xii). I shall explore the deeper significance of this quote below, but it is clear already that this problem is considerably more complex than simply taking an inventory of a firm's knowledge base, since knowledge is more like a dynamic process than a static product.

C. PROSPECTS FOR OVERCOMING TACIT KNOWLEDGE PROBLEMS

Given the attention that has been focused on tacit knowledge recently, it should come as no surprise that there is now a lively debate and lack of consensus over the prospects for overcoming the problems outlined above. Most of the discussion has been centred explicitly around the third problem, although implicit arguments concerning the first two problems can also be discerned. At least three distinct positions are evident within the literature, each of which produces its own distinctive vision of the geography of tacit knowledge.

Position 1. The learning region

The learning regions thesis is now well established in economic geography, regional economic planning, and the (regional) innovation systems literature (see Florida, 1995; Asheim, 1996; Morgan, 1997; Cooke and Morgan, 1998; Maskell and Malmberg, 1999; Lundvall and Maskell, 2000). In a nutshell, it argues that tacit knowledge does not 'travel' easily. This is because its transmission is best shared through face-to-face interaction between partners who already share some basic similarities: the same language; common 'codes' of communication; shared conventions and norms; personal knowledge of each other based on a past history of successful collaboration or informal interaction. These commonalities are said to serve the vital purpose of building trust between partners, which in turn facilitates the local flow of tacit knowledge between partners.[5]

While this analysis appears, on the surface, to be solely concerned with the sharing of tacit knowledge (i.e. problem 3), it also implicitly addresses the first and second problems (tacit knowledge production, identification and appropriation). Because this approach has adopted the learning-by-interacting model as the cornerstone of its conceptual framework, it argues that the production of tacit knowledge occurs simultaneously with the act of transmission – primarily through the mechanism of user-producer interaction (Lundvall, 1988; Gertler, 1995). According to this perspective, knowledge does not flow unidirectionally from technology producers to users. Instead, users provide tacit knowledge to producers in order to enable the latter to devise innovative solutions to users' practical problems. But at the same time, by supplying users with innovative technologies, producers are also sharing their tacit knowledge with their customers. The end product arising from this close interaction benefits both users and producers, and embodies within it new tacit knowledge that could not have been produced by either party working in isolation. This, in effect, describes a social process of joint innovation and tacit knowledge production.

On the related issue of finding and appropriating tacit knowledge, the learning region

[5] In a recent paper, Cohen and Fields (1999) question the extent of similarity between Silicon Valley and the 'paradigmatic' European cases of learning regions and industrial districts. They contend that the social cohesion within Silicon Valley is based more on widely circulated knowledge concerning the reputations and reliability of individual firms, as well as interfirm mobility of skilled workers, rather than on deep cultural similarities borne of decades (if not centuries) of close social interaction between firms. Consistent with this view, Florida's (1995) conception of a learning region is considerably more modest than those espoused by European authors on the subject.

approach at least implies that firms will search locally first, for reasons well justified in economic terms. Their intimate knowledge of other local firms and their capabilities is built up through past interaction and/or word-of-mouth referrals and local reputation (i.e. network) effects. This 'local knowledge' greatly improves their odds of finding the right 'match'. Moreover, as is clear from the above discussion, appropriation (access to and successful absorption) of another firm's tacit knowledge is greatly facilitated by the bonds of trust that have developed between such local partners over time, or which are supported by strong locally-grounded deterrents to opportunistic behaviour by potential innovation partners with respect to the use of one another's intellectual property.

The tacit knowledge geography associated with this perspective is clear and unequivocal: since spatial proximity is key to the effective production and transmission/sharing of tacit knowledge, this reinforces the importance of innovative clusters, districts, and regions. Moreover, as Maskell and Malmberg (1999) point out, these regions also benefit from the presence of localized capabilities and intangible assets which further strengthen their centripetal pull. Many of these are social assets – i.e. they exist between rather than within firms (Leonard and Swap, 2000). Although they are therefore not fully appropriable by individual firms, only local firms can enjoy their benefits. These assets also include the region's unique institutional endowment, which can act to support and reinforce local advantage. Because such assets exhibit strong tendencies of path-dependent development, they may prove to be very difficult to emulate by would-be imitators in other regions, thereby preserving the initial advantage of 'first mover' regions. They argue (p. 181):

> It is the region's distinct institutional endowment that embeds knowledge and allows for knowledge creation which – through interaction with available physical and human resources – constitutes its capabilities and enhances or abates the competitiveness of the firms in the region. The path-dependent nature of such localised capabilities makes them difficult to imitate and they thereby establish the basis of sustainable competitive advantage [emphasis in original].

Recently, Allen (2000) has raised some important questions about the 'self-evident truths' at the heart of the learning region thesis. In particular, he doubts the validity of the underlying assumption that tacit knowledge can only be connected to the local scale, while codified knowledge is necessarily global in reach or availability. He sees this dualism as unhelpful to our understanding of the geography of knowledge flows, considering it "a flawed, if not spurious, exercise" (30). He suggests that "distanciated contacts" and "'thick' relationships may span organizational and industry boundaries, as can the puzzles and performances which constitute them" (28). In asserting that "the translation of ideas and practices...[is] likely to involve people moving to and through 'local' contexts, to which they bring their own blend of tacit and codified knowledges, ways of doing things and ways of judging things" (28), his arguments anticipate a second position evident in the literature.

Position 2. Communities of practice

A more recent literature, some of which also traces its intellectual lineage back to a competence-based view of the firm, emphasizes the central role of 'communities of practice' as key entities driving the firm's knowledge-processing activities. This literature argues that routines and established practices shaped by organizations (or subset communities within organizations) promote the production and sharing of tacit knowledge (Brown and Duguid, 1996; 2000; Wenger, 1998; Wenger and Snyder, 2000). Communities of practice are defined as groups of workers informally bound together by shared experience, expertise and commitment to a joint enterprise. These communities normally self-organize for the purpose of solving practical problems facing the larger organization, and in the process they produce innovations (both product and process). The commonalities shared by members of the community facilitate the identification, joint production and sharing of tacit knowledge through collaborative problem-solving assisted by story-telling and other narrative devices for circulating tacit knowledge.

Thus, according to this approach, organizational or relational proximity and occupational similarity are more important than geographical proximity in supporting the production, identification, appropriation and flow of tacit knowledge (Amin, 2000; Amin and Cohendet, 1999; 2000). The resulting tacit knowledge geography is distinctly different from that which is envisioned by adherents to the learning region approach. In this view, the joint production and diffusion/transmission of tacit knowledge across intra-organizational boundaries is possible, so long as it is mediated within these communities. Moreover, because communities of practice may extend outside the single firm to include customers or suppliers, tacit knowledge can also flow across the boundaries of individual organizations.

To this point, the argument does not appear to differ substantially from the user-producer interaction perspective inherent in the learning region approach. However, the communities of practice literature asserts plainly that tacit knowledge may also flow across regional and national boundaries if organizational or 'virtual community' proximity is strong enough – a phenomenon that Bunnell and Coe (2001) refer to as the 'de-territorialisation of closeness'. In other words, learning (and the sharing of tacit knowledge) need not be subject to the 'friction of distance' if relational proximity is present. Amin (2000, p. 14) states the case with characteristic eloquence:

> Is it not relational proximity – more specifically, ongoing organisational routines and the social practices of collectives implicated in a common venture – rather than geographical proximity, that constitutes the 'soft' architecture of learning? Such relational proximity might, of course, draw on face-to-face contact, but it can also be achieved at a distance (isn't this what the communications revolution and global business travel are all about?). More importantly, relational proximity does not in any way implicate, a priori, local clustering or any of the other properties of place that economic geographers and geographical economists have come to stress in recent years.

Rather than seeing "the local as a unique source of tacit knowledge for competitive advantage," Amin argues that "it is within organisational spaces, with their complex geographies blending action at a distance and local practices, that codified and tacit knowledge are mobilised for competitive advantage" (2000, p. 14). Allen (2000, 28) concurs, noting that:

> What matters in such situations is not the fact of local embeddedness, but the existence of relationships in which people are able to internalize shared understandings or are able to translate particular performances on the basis of their own tacit and codified understandings.

In other words, in place of local context, this perspective substitutes organizational context as the crucial social environment shaping tacit knowledge production, identification, appropriation, absorption and circulation. These arguments are useful reminders of the importance of relationships and the strength of underlying similarities rather than geographical proximity per se in determining the effectiveness of knowledge-sharing between economic actors. However, they do beg one very important question: what forces shape or define this 'relational proximity', enabling it to transcend physical, cultural and institutional divides? How are "shared understandings" produced? Much of the communities of practice literature is largely silent on this question, although the work of Brown and Duguid (1996; 2000) stands out as a clear exception.

Brown and Duguid freely acknowledge a potential problem when they argue that tacit knowledge cannot be assumed to circulate freely just because the technology to support its circulation is available. This conclusion is especially noteworthy considering that Brown holds the post of Chief Scientist and Director of the Xerox Palo Alto Research Centre (PARC), an organization that Schoenberger (1997, 187) describes as "one of the most productive and creative computer research centres in the country", established in the heart of Silicon Valley in 1970.[6] In sharp contrast to the arguments reviewed above, Brown and Duguid (2000) stake out a very different position on the spatial reach of communities of practice (143):

> They are relatively tight-knit groups of people who know each other and work together directly. They are usually face-to-face communities that continually negotiate with, communicate with, and coordinate with each other directly in the course of work. And this negotiation, communication, and coordination is highly implicit, part of work practice,...work chat. ... Groups like this cultivate their own style, their own sense of taste, judgment, and appropriateness, their own slang and in-terms. ... In these groups, the demands of direct coordination inevitably limit reach. You can only work closely with so many people. ... Ideas and knowledge may be distributed across the group, not held individually. These groups allow for highly productive and creative work to develop collaboratively.

On the use of information technologies per se, they are equally unequivocal (146):

> Yet for the sort of implicit communication, negotiation, and collective improvisation that we have described as part of practice, learning, and knowledge sharing, it's clear that

[6] As evidence of her claim, Schoenberger notes (188) that "PARC staffers, in a remarkably short time, developed many of the essential hardware and software components of...[a new, open information architecture]. These included personal computers, graphics interfaces, laser printers, WYSIWYG...word processing programs, and networking capability."

> there are advantages to working together, however well people may be connected by technology. Indeed, one of the most powerful uses of information technology seems to be to support people who do work together directly and to allow them to schedule efficient face-to-face encounters.

In their view, the narratives and social ties so crucial to the flow of knowledge within communities of practice are deeply embedded within the social systems in which they arise. This view provides a convenient bridge to the third perspective on tacit knowledge problems.

Position 3. Knowledge enablers

In contrast to the optimistic outlook of the communities of practice literature (Brown and Duguid excepted), another recent body of work begins from a rather different premise. It argues that while organizations may be able to produce tacit knowledge effectively (implicitly, using spatially concentrated resources to achieve this), it is devilishly difficult to disseminate or share it more widely ("harness" it) within the organization. This problem has become the focus of a huge effort by firms (especially large ones), and has come to be recognized – even by those who originally promoted the idea of a 'knowledge-creating company' – as a very significant obstacle to greater innovativeness (Ichijo, von Krogh and Nonaka, 1998; von Krogh, Ichijo and Nonaka, 2000). This literature sets about to document some of the creative ways in which some firms have responded to this situation, emphasizing the key role of knowledge enablers – that is, 'knowledge activists' who aim to span boundaries within the large organization, acting as agents for the diffusion of tacit knowledge – normally with at least partial codification in the process of transmission.

The boundary-spanning strategies of these knowledge activists make heavy use of story-telling as a key mode of tacit knowledge transfer. But even this can only work when supported by direct, face-to-face interaction and communication between people. For this reason, another key element of a knowledge-enabling strategy is the circulation of key personnel between head office and branch locations (or between different branches) around the globe.

The geography of tacit knowledge implicit in this approach is subtly but importantly different from either of the first two positions reviewed above. While the production of tacit knowledge remains strongly localized, the possibilities for its dissemination – once produced – create large spread effects within multi-divisional and multi-locational organizations. There is also at least the potential for wider diffusion of this knowledge outside the organization, if the appropriate enablers are in place.

In their recent book, von Krogh et al. (2000) argue that "microcommunities of knowledge" play a key role to ensure the success of this tacit knowledge circulation within large organizations. These are small groups (typically no more than five to seven people) whose members are strongly bound together through common work histories and who employ face-to-face interaction as their most important modus operandi. Of course, von Krogh et al. recognize that 'geography' makes all of this more difficult and challenging. It is clear from their discussion that for them, 'geography' signifies both physical separation and local cultural

differences. While they emphasize the importance of a common or shared "social context" in facilitating the flow of tacit knowledge, they view the creation and shaping of this context as primarily within the purview of the firm.[7] Furthermore, although they offer detailed renderings of fascinating case studies involving the transmission of tacit technological knowledge between culturally (as well as physically) distant sites (e.g. advanced intercity rail technology being transposed from Switzerland to India), they provide no real insights into how 'local culture' is produced.

D. TACIT KNOWLEDGE REVISITED: A TWO-POLANYI APPROACH

What seems clear from the preceding discussion is that considerable disagreement and confusion persists concerning the nature of tacit knowledge and its relationship to the geography of innovation. I will argue in this section that the principal reason for this confusion stems from the relatively limited and superficial interpretation of the concept adopted by most scholars up until now. Furthermore, these limitations arise from a too literal reliance on Michael Polanyi's own particular conception of tacit knowledge. My goal here is to reconstruct our understanding of this notion based on more robust foundations which allow us, in particular, to develop a deeper understanding of the true meaning and significance of local context or culture.

Recalling our earlier discussion, Polanyi's original conception of tacit knowledge is primarily experiential and cognitive in nature. It is experiential in the sense that he conceives of tacit knowledge as an understanding of 'know-how,' acquired through experience. It is cognitive in the sense that it defies conscious articulation – meaning that (i) we may not even be aware of it, and (ii) when we try to articulate or explain it to someone else, communicating this knowledge in verbal, written or diagrammatic form will never be fully equal to the task. Hence, tacit knowledge must be learned by demonstration, imitation,[8] performance and shared experience: "I cannot explain very well how I do this, so let me show you". Polanyi asserts that tacit knowledge is context-dependent in the sense that common rules shared between one person and another are important for the successful transmission of tacit knowledge. However, perhaps the reason so many have gone astray in applying Polanyi's concept is that he never fully specifies how 'context' and 'rules' are produced. Instead, they remain primarily idiosyncratic and 'cultural' in origin, in line with his larger project to legitimize the personal, passionate pursuit of knowledge by individual scholars as the driving force behind scientific advance.[9]

This suggests to us that we cannot sort out the geography of tacit knowledge without inquiring more systematically into the fundamental nature of 'culture' and the institutional underpinnings of economic activity. Ironically, the source for a more helpful perspective on this

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[7] In doing so, they seem to accept uncritically the typical corporate hubris that represents 'corporate culture' as the all-powerful but easily malleable plaything of senior company executives, operating independently of a wider social or regulatory context. For penetrating critiques of this position, see Schoenberger (1997) and Glasmeier (2001).

[8] Brown and Duguid (2000, 136) liken this to theft, referring to "stolen knowledge" – that which is acquired by unobtrusive or covert observation of expert performances, rather than through formal instruction.

[9] "Tacit assent and intellectual passions, the sharing of an idiom and of a cultural heritage, affiliation to a like-minded community: such are the impulses which shape our vision of the nature of things on which we rely for our mastery of things" (Polanyi, 1958, p. 266)

issue is another well-known Polanyi – Michael's older brother, Karl – whose classic work (1944) yields the central insight that markets and the behaviour of economic actors are socially constructed, embedded and governed. This has important implications for all three tacit knowledge problems. It suggests that the ability of individual workers or firms to produce and share tacit knowledge depends on much more than spatial proximity or cultural affinity. In particular, it depends on institutional proximity – that is, the shared norms, conventions, values, expectations and routines arising from commonly experienced frameworks of institutions. This form of proximity or affinity may override organizational or relational proximity if the organization in question extends geographically across institutional divides.

Karl Polanyi's work also suggests that the ability of firms to find and appropriate the tacit knowledge produced by individual workers on the shop (or office, or laboratory) floor, or by teams (communities) will be highly sensitive to the institutions governing the employment relation, which, themselves, vary geographically by nation and region (Kochan and Osterman, 1994; Wever, 1995).

These insights suggest that we need to devise an alternative conception of tacit knowledge, since (Michael) Polanyi's famous aphorism "we can know more than we can tell" seems to lead us – unproductively, in my view – into the realm of psychology, cognitive science, sensory perception, and the psychomotor foundations of skilled performance, without paying equivalent attention to the broader (geographically delimited) context within which such performances are situated.[10] Instead, we might find it more useful to reject this phrase in favour of alternative formulations such as: 'we do not understand what we know, or why we do things the way we do'. Following Karl's inspiration, then, we can more productively interpret the origins of routines, characteristic practices, 'settled habits of thought', and 'second nature' as arising from concrete institutional origins: while corporate agency and the distinctive 'culture' of the firm undoubtedly play a major role, they do not exist within a vacuum (Schoenberger, 1997; Glasmeier, 2001) and, contrary to the underlying premise of much of the knowledge management literature, managers do not fully (or even largely) shape their own destiny. They operate within a possibility set that is constrained by larger forces – particularly the institutional and regulatory frameworks at the national and regional scales (Lam, 1998; Lam and Lundvall, 2000; Whitley, 1999).[11]

These frameworks influence firms' practices, values, and expectations in fundamental ways. The structure of capital markets has a profound influence over firms' time horizons,

[10] One warning of the potentially futile direction in which this leads us comes from the curious nature of virtually *all* of the examples used to convey the meaning of tacit knowledge à la Michael Polanyi: recognizing a face, riding a bicycle, swimming, playing a piano, or more recently, landing an airplane or baking bread. The connections between examples such as these, which emphasize the psychomotor properties of performance of physical skills, and innovative practices in regional and national economies seem remote.

[11] In contrast to this analysis of Karl Polanyi's contribution to our understanding of the origins of tacit knowledge and context, Allen (2000, 27) argues that the problematic dualism of local/tacit versus global/codified knowledge arises from the widespread tendency to blend together Karl's central idea of embeddedness with Michael's idea of tacitness. My own interpretation differs from Allen's: where he sees 'embeddedness' as the culprit, I would suggest instead a less than careful reading of Karl's more fundamental argument concerning the institutional underpinnings of economic action. In my view, the real confusion has arisen from excessive reliance on the ideas of Michael, to the neglect of Karl's insights.

which in turn shape engineers' choices of production technologies, the design characteristics of their products, but also firms' interest and willingness to engage in long-term, close interaction with potential local innovation partners (Gertler, 1997; 2001b). The structure of corporate governance systems shapes and constrains the firm's strategic priorities and time horizons, as well as its managers' abilities to organize the workplace in order to 'reap' workers' tacit knowledge (O'Sullivan, 2000). The shape of labour market legislation and industrial relations regulation affects crucial variables such as training regimes, rates of labour force turnover, inter-firm mobility, and the ability of employers to retain 'talent' (Wever, 1995).

There are two general points arising from this analysis. The first is that 'context' is, to a very large degree, defined by such institutional features. Of course, as Maskell and Malmberg (1999, p. 173) point out, the institutional endowment of a region or nation accumulates over time, and "thus represents the intricate contemporary interaction between elements of different ages ... – from the very old (religion, beliefs, values) to the recent/current (contemporary industry standards, current regulations, etc.)." The second point – and the explicit link to tacit knowledge – is that such institutional influences are subtle but pervasive: indeed, often so subtle that firms and individuals are not even conscious of the impact they exert over their own choices, practices, attitudes, values and expectations. That firms remain almost completely oblivious to the influence of these institutional forces becomes readily apparent whenever they attempt to engage in learning which spans institutionally defined contextual divides – whether this is between different firms or between different divisions/branches of the same firm situated in different institutional settings (Gertler, 2001a; 2001b).

Consider some brief examples to illustrate this point. Returning to the case of Xerox, Schoenberger documents how the parent corporation, based on the east coast of the United States, was singularly incapable of reaping the commercial benefits of the innovations produced in its 'peripheral' research sites – Xerox PARC in Palo Alto or its foreign subsidiary Fuji Xerox in Japan. Her careful analysis of this sorry tale reveals that the principal impediment to successful commercialization was the fact that these peripheral research sites operated under radically distinct cultures and contexts, defined by divergent institutional frameworks at the regional or national scale. Hence, despite the stellar track record of innovation at PARC, its most important new product ideas and system innovations were appropriated by other firms such as Apple and Microsoft. Similarly, the innovations developed at Fuji Xerox were significant enough to have offered the parent firm a viable new product technology at a time when its existing products were quickly losing market share. But the larger corporation proved itself incapable of learning from its smaller 'outpost' operations, despite unequivocal evidence of clearly superior technologies (Schoenberger, 1999).

These cases demonstrate that learning, when attempted across major institutional-contextual boundaries, will be subject to formidable obstacles, even in the presence of substantial corporate wealth and resources. They also throw into sharper relief the quote cited earlier from the Chairman of Hewlett-Packard: 'knowing' what HP knows is more than a matter of simply identifying, cataloguing and providing ready access to all knowledge in the firm (itself a formidable prospect). The inevitable geographical variations in institutionally defined local context are endemic to organizations as large as HP, meaning that fully 'knowing' what some key employee, situated in a far-flung corner of the corporation, knows will be all but impossible.

And even if one could know this, the ability or inclination of central management to act on this knowledge would also surely be limited.

The upshot is that transcending the bonds of spatial proximity may be possible, but it will also be difficult and expensive, because of the fundamentally different institutional environments involved – what we might understand as the distinctive and uneven (though systematic) 'economic geography of context'. Technological fixes and corporate willpower alone may not be sufficient to overcome these obstacles.

In conclusion, I have argued above that there are three distinct tacit knowledge problems, not one. The line of argument pursued in this paper suggests that students of innovation need to think harder and more carefully about how tacit knowledge and context are produced before we can say anything intelligent about the conditions under which tacit knowledge can most readily be shared – that is, when 'proximity' is important: what types and why.

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