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Tacit Knowledge, Organizational Learning and Societal Institutions: An Integrated Framework*

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Abstract

The importance of tacit knowledge in organizational learning and innovation has become the focus of considerable attention in the recent literature. Our understanding of the nature of the links between tacit knowledge and organizational learning, however, has been hampered by the lack of a conceptual framework integrating micro-level learning activities with organizational forms and macro-level societal institutions. This paper seeks to achieve such an integrative task. It argues that there is an interactive relationship between dominant knowledge types and organizational forms. Further, the extent to which tacit knowledge constitutes the knowledge base of the firm, and how it is formed and used are powerfully shaped by the broader institutional context. The paper develops a four-fold typology at the cognitive, organizational and societal levels, as an analytical framework to explain the links between knowledge types, organizational forms and societal institutions. It shows how the three levels interact to shape the learning and innovative capabilities of firms. The theory developed in this paper represents the first attempt to integrate the diverse strands of literature and different levels of analysis into a single coherent framework.

Descriptors: tacit knowledge, organizational learning, innovation, societal institutions, learning economy

Introduction

Knowledge is increasingly regarded as the critical resource of firms and economies (Drucker 1993; Quinn 1992; Reich 1992). Much recent attention has focused on the importance of 'tacit knowledge' for sustaining firms' competitiveness (Grant 1996; Hall 1993; Winter 1987; Teece and Pisano 1994), and its role in technological innovation and organizational learning (Senker 1995; Howells 1996; Nonaka and Takeuchi 1995; Spender 1996b). While there is a growing body of literature on the role of tacit knowledge in firms' learning and innovation activities, our understanding of the nature of tacit knowledge and its relationship with organizational learning has been hampered by the lack of a coherent conceptual framework integrating micro-level learning activities with organizational forms and macro-level societal institutions. This paper seeks to achieve such an integrative task, and in so doing, it introduces a societal perspective to the debate which

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has been largely absent in the existing literature. The paper argues that there is an interactive relationship between dominant knowledge types and organizational forms. Further, the extent to which tacit knowledge constitutes the knowledge base of the firm, and how it is formed and used are powerfully shaped by the broader institutional context (Boisot 1995a, 1995b; Lam 1996, 1997). The knowledge of the firm is socially embedded. It is rooted in firms' coordination mechanisms and organizational routines which, in turn, are heavily influenced by societal institutions. The purpose of this paper is to develop a typological framework, at the cognitive, organizational and societal levels, to explain the links between knowledge types, organizational forms and societal institutions. It shows how these three levels interact to shape the learning and innovative capabilities of firms. It focuses on the role of tacit knowledge and how firms located in different institutional contexts might differ in their capability to mobilize it.

The framework developed in this paper builds on and integrates the following three major strands of literature. First, the theory of knowledge and organizational learning, most notably the work of Polanyi (1962, 1966), Nelson and Winter (1982), Spender (1996a, 1996b) and Nonaka (1994), which seeks to understand the nature of knowledge and organizational learning from a pluralistic epistemological perspective. It distinguishes between explicit and tacit knowledge and argues that the interaction between these two modes of knowing is vital for the creation of new knowledge. Their emphasis on tacit knowing as the origin of human knowledge directs our attention to the social and interactive nature of learning. Second, the paper also draws upon the theoretical insights of the resource- or knowledge-based theory of the firm. Following Penrose (1959), the knowledge-based theory sees the firm as a body of knowledge residing in its structures of coordination, which in turn, defines the social context for cooperation, communication and learning (Nelson and Winter 1982; Kogut and Zander 1992, 1996; Fransman 1995). At the heart of this theory is the idea that the primary role of the firm, and the essence of organizational capability are the integration and creation of knowledge (Spender 1996a; Grant 1996; Tsoukas 1996). Differences in the organizing principles of firms thus reflect their differing knowledge base and learning capabilities. Finally, the perspective adopted in this paper follows the 'societal' approach in industrial sociology, and builds on the theoretical foundations of the literature on the 'national systems of innovation'. The 'societal' approach demonstrates how external societal institutions interact with internal organizational structures and processes to generate societally distinctive organizational forms (Maurice et al. 1986; Sorge and Warner 1986; Maurice 1995). Literature on 'national innovation systems', most notably the work of Freeman (1987, 1995), Lundvall (1992) and Nelson (1993), seeks to understand the link between national institutions, primarily at the macro-level, and the innovative performance of firms and economies. Lundvall's work is particularly relevant in highlighting the 'specificity' and 'interconnectedness' of societal institutions' bearing on learning and innovation.

This paper represents the first attempt to integrate the above three intel-

lectual developments to build a systematic conceptual framework to explain how knowledge, organizational forms and societal institutions interact to shape learning and innovation. The concept of 'social embeddedness', referring to how behaviour and institutions are affected by networks of social relations (Granovetter 1985), is used as an umbrella concept bridging the three levels of analysis. At the *cognitive level*, the notion of social embeddedness underlines the 'tacit' nature of human knowledge and the dynamic relationship between individual and collective learning. It draws our attention to the fact that a large part of human knowledge, such as skills, techniques and know-how, and 'routines', cannot be easily articulated or communicated in codified forms. Knowledge of this kind is experience-based: it can only be revealed through practice in a particular context and transmitted through social networks. At the *organizational level*, it focuses on how the organizing principles of the firm shape the social structure of coordination, and the behavioural routines and work roles of organizational members within which the knowledge of the firm is embedded. The structure of coordination determines the organization's capability to mobilize and integrate different types of knowledge, and shapes the relationship between individual and collective learning. At the *societal level*, it draws attention to the way societal institutions shape organizational routines and coordination rules. This paper focuses on the education and training system, and types of labour markets and careers as the key societal institutions that shape work organization and the knowledge base of the firm. Education and training shape the social constitution of 'knowledge', and thus provide the basis of qualification, work status and job boundaries. As such, they influence the relative status and importance of different types of knowledge, and the nature of their interaction. The types of labour market determine the locus of learning, the incentives for developing different types of knowledge, and they define the boundary and social framework within which individual learning interacts with collective learning. These institutional features interact with organizational structures and processes to generate different types of knowledge, patterns of learning and innovation.

The following sections explore the coherence between the three levels of analysis, and examine how and why organizations differ in their ability to mobilize tacit knowledge as a source of learning and innovation.

Knowledge Within the Firm: Characteristics, Attributes and Types

This section gives a micro-level analysis of the attributes of different types of knowledge and constructs a typology of organizational knowledge. The knowledge of the firm can be analyzed along two dimensions: the epistemological and the ontological. The former concerns the modes of expression of knowledge, namely, Polanyi's distinction between explicit and tacit knowledge. The latter relates to the locus of knowledge which can reside

at the individual or collective levels. These two dimensions give rise to four different forms of organizational knowledge: 'embrained', 'embodied', 'encoded' and 'embedded' knowledge (see Figure 1).

The Epistemological Dimension: Explicit vs. Tacit Knowledge

Human knowledge exists in different forms; it can be articulated explicitly or manifested implicitly (tacit). The critical differences between them lie in three major areas. The first area is the codifiability and mechanisms for transferring knowledge. Explicit knowledge can be codified. It belongs to Popper's (1972) 'World three' knowledge: it can be abstracted and stored in the 'objective world', and understood and shared without a 'knowing subject'. Ease of communication and transfer is its fundamental property. Knowledge which is tacit, in contrast, is intuitive and unarticulated. It resides in Popper's 'World two' where knowledge cannot be communicated, understood or used without the 'knowing subject'. Polanyi (1962) argues that a large part of human knowledge is tacit. This is particularly true of operational skills and know-how acquired through practical experience. Knowledge of this type is action-oriented and has a personal quality that makes it difficult to formalize or communicate. Unlike explicit knowledge which can be formulated, abstracted and transferred across time and space independently of the knowing subjects, the transfer of tacit knowledge requires close interaction and the build up of shared understanding and trust among them.

Second, the main methods for the acquisition and accumulation of these two knowledge forms also differ. Explicit knowledge can be generated through logical deduction and acquired by formal study. Tacit knowledge, in contrast, can only be acquired through practical experience in the relevant context, i.e. 'learning-by-doing'. Moreover, as Nonaka observed (1994: 21–22), the 'variety' of experience and the individual's involvement in the 'context' are critical factors determining its generation and accumulation.

Third, the two forms of knowledge differ in their potential for aggregation and modes of appropriation. Explicit knowledge can be aggregated at a single location, stored in objective forms and appropriated without the participation of the knowing subject. Tacit knowledge, in contrast, is personal and contextual. It is distributive, and cannot be easily aggregated. The realization of its full potential requires the close involvement and cooperation of the knowing subject.

Although it is possible to distinguish conceptually between explicit and tacit knowledge, they are not separate and discrete in practice. Nonaka and Takeuchi (1995) argue that new knowledge is generated through the dynamic interaction and combination of these two types. In a similar vein, Nelson's and Winter's (1982) evolutionary theory of the firm assumes that the firm provides a special context in which the explicit and tacit modes of knowledge are selected by interaction with the external economic reality and then stored in organizational routines. Over time, the quality of the

interaction between the explicit and evolving tacit types of knowledge may lead to superior firm performance. However, firms differ in their capacity for fostering such interaction, and the relative importance and status of the two types may also vary. More importantly, the creation of new knowledge in itself will necessarily involve the use and generation of tacit knowledge. Polanyi (1962, 1966) sees the origin of all human knowledge in individual intuition. The learning and innovative capability of an organization is thus critically dependent on its capacity to mobilize tacit knowledge and foster its interaction with explicit knowledge.

The Ontological Dimension: the Individual vs. Collective

Knowledge within the firm can reside at the level of the individual, or be shared among members of the organization. Individual knowledge is that part of the organization's knowledge which resides in the brains and bodily skills of the individual. It is a repertoire of knowledge 'owned' by the individual, which can be applied independently to specific types of task or problem. Autonomy in application is its key characteristic. Given the cognitive limits of the individual in storing and processing information — Simon's (1957) 'bounded rationality' problem — individual knowledge is inevitably specialized and domain-specific. Individual knowledge is also transferable, moving with the person, giving rise to potential problems of retention and accumulation.

Collective knowledge refers to the ways in which knowledge is distributed and shared among members of the organization. It is the accumulated knowledge of the organization stored in its rules, procedures, routines and shared norms which guide the problem-solving activities and patterns of interaction among its members. Collective knowledge resembles the 'memory' or 'collective mind' of the organization (Walsh and Ungson 1991). It can either be a 'stock' of knowledge stored as hard data; or represent knowledge in a state of 'flow' emerging from interaction. Collective knowledge exists between rather than within individuals. It can be more, or less, than the sum of the individuals' knowledge, depending on the mechanisms that translate individual into collective knowledge (Glynn 1996: 1093–1094).

Figure 1
Cognitive Level:
Knowledge Types

		Ontological dimension	
		individual	collective
Epistemological dimension	explicit	Embrained knowledge	Encoded knowledge
	tacit	Embodied knowledge	Embedded knowledge

Four Types of Knowledge

The explicit–tacit and individual–collective dimensions of knowledge give rise to four categories of knowledge: ‘embrained’, ‘embodied’, ‘encoded’ and ‘embedded’ knowledge. These conceptual distinctions were first suggested by Collins (1993) to explain the psychological and behavioural aspects of knowledge. Blackler (1995) adapts them to describe the different ‘images’ of knowledge within organizations. The typology presented here integrates the cognitive and organizational dimensions. It relates the characteristics of knowledge to its specific embodiment, linking the process of generation and utilization with its cognitive dimension.

Embrained Knowledge

Embrained knowledge (individual–explicit) is dependent on the individual’s conceptual skills and cognitive abilities. It is formal, abstract or theoretical knowledge. Scientific knowledge, which focuses on the rational ‘understanding’ and ‘knowing’ of universal principles or laws of nature, belongs to this category. Embrained knowledge enjoys a privileged social status within Western culture. The high occupational status of science compared with engineering reflects this. Moreover, the historical attempt by engineers in Britain and the United States to emphasize the conceptual components of their activity represents a conscious attempt to seek status enhancement in society (Layton 1974, 1976).

Embodied Knowledge

Embodied knowledge (individual–tacit) is action oriented; it is the practical, individual type of knowledge on which Polanyi (1962, 1966) focused. In contrast with embrained knowledge which depends on abstract theoretical reasoning (‘knowing’), embodied knowledge builds upon ‘bodily’ or practical experience (‘doing’). It has a strong automatic and voluntaristic component; its generation and application does not need to be fitted into or processed through a conscious decision-making schema (Spender 1996b: 67). Embodied knowledge is also context specific; it is ‘particular knowledge’ which becomes relevant in practice only ‘in the light of the problem at hand’ (Barley 1996). Its generation cannot be separated from application.

Encoded Knowledge

Encoded knowledge (collective–explicit), sometimes referred to as ‘information’, is conveyed by signs and symbols. It is knowledge that has been codified and stored in blueprints, recipes, written rules and procedures. It tends to generate a unified and predictable pattern of behaviour and output in organizations. The abstraction of individuals’ experience and knowledge into encoded knowledge also facilitates centralization and control in organizations. This is well-illustrated by the principles of Scientific Management which attempt to codify worker experiences and skills into objective sci-

entific knowledge. Encoded knowledge is inevitably simplified and selective, for it fails to capture and preserve the tacit skills and judgement of individuals.

Embedded Knowledge

Embedded knowledge is the collective form of tacit knowledge residing in organizational routines and shared norms. It is the Durkhemian type of tacit knowledge based on shared beliefs and understanding within an organization which makes effective communication possible. It is rooted in an organization's 'communities-of-practice', a concept used by Brown and Duguid (1991) to denote the socially constructed and interactive nature of learning. Embedded knowledge is relation-specific, contextual and dispersed. It is organic and dynamic: an emergent form of knowledge capable of supporting complex patterns of interaction in the absence of written rules.

Knowledge Types and Organizational Forms: Four Contrasting Models of Organizational Learning

All organizations potentially contain a mixture of knowledge types. However, their relative importance can differ. Organizations may be dominated by one type rather than another, and their capacity for harnessing tacit knowledge can vary greatly. This section examines how the different types of knowledge articulate within different organizational structures. The analysis indicates an interactive relationship between dominant knowledge types and organizational forms, resulting in different dynamics of learning and innovation.

Organizations characterized by an explicit knowledge base tend to have formal structures of control and coordination, and exhibit highly standardized tasks and work roles. Explicit knowledge can be standardized and aggregated. It is thus possible to specify and pre-determine the repertoire of knowledge and skills required for task performance. In contrast, organizations with a tacit knowledge base will exhibit a decentralized structure and use informal coordination mechanisms. This is because tacit knowledge is dispersed and subjective; it cannot be standardized, disembodied or pre-determined. Its mobilization requires autonomy and commitment on the part of the knowing subject. Without such conditions, tacit knowledge remains latent.

Organizations can also depend on different knowledge agents. Those which rely heavily on the contributions of key individuals will tend to accord them a high degree of autonomy. In contrast, those which draw their capability from the collective knowledge of their members will need to develop effective mechanisms for integration and coordination.

Drawing upon Mintzberg's (1979) classic typology of organizational forms and the work of Aoki (1988) and Nonaka and Takeuchi (1995) on the 'Japanese model', the analysis below distinguishes four ideal-typical orga-

nizational forms (see Figure 2). It argues that each organizational form is associated with a dominant knowledge type, giving rise to four contrasting configurations: 'professional bureaucracy' and embrained knowledge; 'machine bureaucracy' and encoded knowledge; 'operating adhocracy' and embodied knowledge; and 'J-form' organization and embedded knowledge. These configurations differ in their ability to mobilize tacit knowledge and hence in their learning and innovative capability.

Figure 2
Organizational
Level:
Coordination and
Learning

		Knowledge agent (autonomy and control)	
		individual	organization
Standardization of knowledge and work	high	Professional bureaucracy	Machine bureaucracy
	low	Operating adhocracy	J-form organization

'Professional Bureaucracy' and 'Embrained Knowledge'

An organization which derives its capability from the formal 'embrained knowledge' of its highly trained individual experts can be defined as a 'professional bureaucracy'. Coordination is achieved primarily by the standardization of knowledge and skills through the individual's formal education and training. The formal knowledge constitutes an important basis of internal work rules, job boundaries and status. Although the professional bureaucracy accords a high degree of autonomy to individual professionals, its structure is primarily 'bureaucratic': coordination is achieved 'by design and by standards that pre-determine what is to be done' (Mintzberg 1979: 351). The source of standardization originates outside the organization. The external education institutions and professional bodies play an important role in defining the standards and boundaries of the knowledge in use.

The individual professionals are the key knowledge agents of professional bureaucracy. They are the 'authorized experts' whose formal training and professional affiliations give them a source of authority and a repertoire of knowledge ready to apply. Problem solving involves the application of an existing body of abstract knowledge in a logical and consistent way. This inevitably restricts the use of tacit knowledge and judgemental skills in dealing with uncertainty in problem solving. As noted by Starbuck (1992), formal expert knowledge often entails 'perceptual filters'. Professional experts have a tendency to interpret specific situations in terms of general concepts and place new problems in old categories. Mintzberg (1979) uses the term 'pigeonholing' to describe how, in a professional bureaucracy, the uncertainty in problem solving is contained in the jobs of single 'experts', and circumscribed within the boundary of conventional specialization. This

allows the organization to uncouple the various specialist tasks and assign them to autonomous individuals, leading to a high degree of individual and functional specialization.

The knowledge structure of a professional bureaucracy is individualistic, functionally segmented and hierarchical. Individual experts have a high degree of autonomy and discretion in the application and acquisition of knowledge within their own specialist areas, but the sharing and dissemination of such knowledge across functional boundaries is limited. The lack of a shared perspective and the formal demarcation of job boundaries inhibit the transfer of non-routine tacit knowledge in day-to-day work. Moreover, the power and status of 'authorized experts' inhibits interaction and the sharing of knowledge with 'non-experts'. The problem of coordination in a professional bureaucracy translates itself into problems of innovation (Mintzberg 1979: 375).

The learning focus of a professional bureaucracy tends to be narrow and constrained within the boundary of formal specialist knowledge. Tacit knowledge is circumscribed and contained and plays a limited role in a professional bureaucracy.

'Machine Bureaucracy' and 'Encoded Knowledge'

A machine bureaucracy depends heavily on 'encoded knowledge'. The key organizing principles are specialization, standardization and control. This is an organizational form designed to achieve efficiency and stability. Coordination of operating tasks is achieved via the standardization of work process, a sharp division of labour and close supervision. The organization displays a continuous effort to formalize operating skills and experience into objective knowledge through codification. The objective is to reduce and eliminate uncertainty in the operating tasks, or, to put it in Mintzberg's words, 'the sealing off of the operating core from disruptive environmental influences' (Mintzberg 1979: 315).

The knowledge agents of a machine bureaucracy are not the individuals directly engaged in operations, but the formal managerial hierarchy responsible for formulating the written rules, procedures and performance standards. There is a clear dichotomy between the 'application' and 'generation' of knowledge. The rules and procedures store the operating knowledge of the organization. The managers are the key agents responsible for translating individual knowledge into rules and procedures and for filtering information up and down the organizational hierarchy. Knowledge within a machine bureaucracy is highly fragmented and only becomes integrated at the top of the hierarchy. The organization relies heavily on management information systems for knowledge aggregation. It is a structural form in which the organization's dependence on the individual's knowledge is minimized. By forming the rules and standards for operation and by centralizing knowledge through the formal hierarchy, the organizational structure and the management information system become knowledge itself (Bonora and Revang 1993). The whole organization operates on the basis of

'encoded knowledge'. A large part of tacit knowledge is naturally lost in the translation and aggregation process.

The knowledge structure of a machine bureaucracy is collective, functionally segmented and hierarchical. The organization seeks to minimize the role of tacit knowledge; it operates on a partial, incomplete and impoverished knowledge base. It learns by 'correction' — through performance monitoring. It can only accumulate new knowledge by means of a slow process of formalization and institutionalization. It is a structure designed to deal with routine problems, but is unable to cope with novelty or change.

'Operating Adhocracy' and 'Embodied Knowledge'

This is a highly organic form of organization with little standardization of knowledge or work process. It relies not only on the formal knowledge of its members, but draws its capability from the diverse know-how and practical problem-solving skills embodied in the individual experts. The administrative function is fused with the operating task, giving the individual experts a high degree of autonomy and discretion in their work. The operating adhocracy has a strong capacity for generating tacit knowledge through experimentation and interactive problem solving.

Coordination in the operating adhocracy is achieved via direct interaction and mutual adjustment among the individual experts operating in market-based project teams. Organizations engaged in providing non-standard, creative and problem-solving services directly to the clients, such as professional partnerships, software engineering firms and management consultancies, are typical examples. In these organizations, formal professional knowledge may only play a limited role; a large part of the problem-solving activities has very little to do with the application of narrow standardized expertise and more to do with the experience and capacity to adapt to new situations. Hence, the importance of 'embodied skills' and 'know-how competencies'. Starbuck's (1992) concept of 'knowledge intensive firms', which emphasizes the significance of 'esoteric expertise' over commonplace standardized knowledge, illustrates the idiosyncratic nature of the knowledge base underlying an operating adhocracy. Sveiby's and Lloyd's (1987) idea of 'know-how companies', in which technical and managerial expertise are integrated, suggests the broad-based and varied nature of the knowledge required for creative problem solving in such organizations.

The knowledge structure of an operating adhocracy is individualistic, but collaborative. The individual experts deployed in market-based project teams are the key knowledge agents. Learning occurs as experts of diverse backgrounds jointly solve shared problems. Unlike in the professional bureaucracy, learning is not confined within the boundary of conventional specialization; it is broad-based and draws upon the diverse experiences and know-how of different experts. Quinn (1992) stresses the importance of 'inter-dependent professionalism' in an operating adhocracy. Learning

occurs on multiple levels, as shifting teams of experts regroup in line with market-based problems. The individual's performance is assessed in terms of market outcomes; the ultimate judges of their expertise are their clients, and not the professional bodies (Starbuck 1992). This is why there is a strong incentive to engage in 'extended occupational learning' and the accumulation of tacit skills beyond the pursuit of formal knowledge.

The knowledge base of an operating adhocracy is diverse, varied and 'organic'. A large part of the knowledge in use is organic, i.e. tacit knowledge generated through interaction, trial-and-error and experimentation. It is an organization capable of divergent thinking, innovation and creative problem solving.

Operating adhocracies are fluid and fast moving organizations and the speed of learning and unlearning is critical for their survival in a complex and dynamic environment. This, however, creates potential problems in knowledge accumulation. The frequent re-structuring and shifting of individuals between project teams means that tacit knowledge may not be fully and adequately articulated before an individual moves on. Another related problem is knowledge retention. The organization's competence is embodied in its members' market-based know-how and skills which are potentially transferable. This makes the organization vulnerable to the loss of its competencies to potential competitors. Starbuck (1992: 725), for instance, talks about the 'porous boundaries' of the 'knowledge intensive firms' and points out that these organizations often find it hard to keep unique expertise exclusive. The operating adhocracy is the most innovative and yet it is the least stable form of organization.

'J-form' Organization and 'Embedded Knowledge'

An organization which derives its capability from knowledge that is 'embedded' in its operating routines, team relationships and shared culture can be described as a 'J-form' organization. The term 'J-form' is used because its archetypical features are best illustrated by the 'Japanese type' of organization, such as Nonaka's and Takeuchi's (1995) 'knowledge creating companies', and Aoki's (1986, 1988) model of the 'J-firm'. The J-form organization combines the stability and efficiency of a bureaucracy with the flexibility and team dynamics of an adhocracy. It allows an organic, non-hierarchical team structure to operate in parallel with its formal hierarchical managerial structure. These two structural layers are 'glued' together by a strong corporate culture, which constitutes the third layer — the knowledge base of the organization. Coordination is achieved via horizontal coordination and mutual adjustment. This is reinforced by shared values embedded in the organizational culture. Nonaka and Takeuchi (1995) use the term 'hypertext organization', an analogy borrowed from computer science, to illustrate the dynamic interaction between the different layers of the organization and the freedom of its members to switch among the different contexts. They argue that the dynamic interaction among the different contexts facilitates the interaction between tacit and explicit knowl-

edge, and that this ultimately determines the capability of the organization to create new knowledge.

The key knowledge agent in the J-form organization is neither the autonomous individual expert nor the controlling managerial hierarchy, but the semi-autonomous project team, comprising members from different functions. The cross-functional team integrates and synthesizes knowledge across different areas of expertise and serves as a bridge between the individual and the organization. It is at the team level, at the intersection between horizontal and vertical flows of knowledge, where the greatest intensity of interaction, learning and knowledge diffusion take place within the J-form organization. Similar to the operating adhocracy, a great deal of the learning occurs through shared work experiences and joint problem solving.

However, unlike the operating adhocracy, where the temporary nature of the project team inhibits the transfer of knowledge generated beyond the level of the team, the J-form organization is capable of diffusing knowledge widely, throughout the entire organization. This occurs as members rotate across functional units and as they return from temporary assignments to formal positions. The formal structure in the J-form organization constitutes an important integrating mechanism. It captures the tacit knowledge generated and stores it at the organization level, for future use. While the operating team is the focal point for the acquisition and generation of knowledge, the dissemination of knowledge in the J-form organization is organization-wide. Knowledge stored in the formal hierarchy constitutes only a small part of the knowledge base of the J-form organization. A large part of the knowledge in use is stored organically in the operating routines and in the networks of human relations.

The J-form organization is adaptive and innovative. It is marked by a tremendous capacity to generate, diffuse and continuously accumulate tacit knowledge through 'learning-by-doing' and interaction. New knowledge is generated through the fusion, synthesis and combination of the existing knowledge base. It has a unique capability to generate innovation continuously and incrementally. However, learning in the J-form organization is also potentially conservative. Its stable social structure and shared knowledge base can reduce the capabilities of the organization to learn from individual deviance and the discovery of contrary experience (Levinthal and March 1993: 108; Dodgson 1993: 383). The J-form organization may find it difficult to innovate radically.

The Role of Tacit Knowledge

The four contrasting organizational forms differ in their ability to harness and mobilize tacit knowledge. The machine bureaucracy seeks to minimize and control tacit knowledge. It operates on an 'impoverished' knowledge base. The professional bureaucracy contains and circumscribes tacit knowledge within the boundary of individual specialization. Tacit knowledge plays only a limited role in a professional bureaucracy: its transfer is inhib-

ited by functional segmentation. The operating adhocracy generates a large quantity of tacit knowledge through experimentation and interactive problem solving, but has a limited capacity to accumulate the tacit knowledge created because of the shifting, fluid organizational structure. The J-form organization has a superior capacity for mobilizing and accumulating tacit knowledge. It allows an organic team structure to operate in tandem with a formal hierarchy and stable social organization.

The Institutional Framework of Knowledge and Organizational Learning

Organizations are socially constituted and their knowledge configurations reflect this. The relative dominance of the different knowledge types, and the ability of an organization to harness tacit knowledge as a source of learning are powerfully influenced by the broader societal and institutional factors. The 'societal' approach, for example, demonstrates an interactive relationship between patterns of work organization and the education and training system, and types of labour markets and careers. Maurice et al (1986) in their comparative studies of organizational structures in France, Britain and Germany, emphasize how the different ways and degrees to which workers are qualified and promoted shape the patterns of coordination and work organization in the three countries. They speak about the degree of 'professionalism' with which tasks are accomplished by different categories of the workforce. By this they mean the relative importance of formal knowledge versus mastery of practical (tacit) skills, and the formal recognition of qualifications. Their study underlines the importance of education and training as a key institutional factor shaping the knowledge configurations and patterns of social interaction within firms.

The role of formal education and qualification systems in defining the knowledge and competence criteria within organizations is closely related to the nature of labour market organization: the extent to which the organization of skills and careers are governed by markets or firms. This broad distinction draws attention to the major differences between an occupation-based labour market (OLM) and a firm-based internal labour market (ILM) (Marsden 1986). Generally speaking, an OLM implies a higher degree of market control over skills and competence criteria and hence a stronger tendency towards formalization and codification of knowledge across firms. In contrast, an ILM allows a greater degree of individual firm control over the definition of expertise, leading to a lower level of standardization of expertise around formal knowledge.

The education and labour market dimensions are inextricably linked and there is an institutional logic defining their specific configurations (see Figure 3). This section examines how these institutional configurations interact with organizational structures and processes to generate different types of knowledge, patterns of learning and innovation.

Figure 3
Societal Level:
Education and
Labour Markets

		Labour Markets (careers and mobility)	
		OLM (market)	ILM (firm)
Education and Training (degree of formalization and academic bias)	high	Professional model	Bureaucratic model
	low	Occupational community model	Organizational community model

Education and Training Systems

There are two principal ways in which education and training systems may be considered to influence the knowledge configurations within firms. The first is the degree of formalization of high-level expertise. This refers to the extent to which high-level expertise is based on abstract theoretical knowledge or concrete practical problems. This is a critical factor shaping the knowledge base of the firm, its approach to problem solving and the nature of relationships between different knowledge types. The second is the degree of academic bias and 'elitism' of the system. This concerns the relative importance and distribution of resources for academic education versus vocational training. It determines the specific mix and distribution of skills among the workforce and hence the pattern of coordination and interactive learning within firms.

Degree of Formalization of High-level Expertise

The degree of formalization of high-level expertise has three inter-related aspects (Whitley 1995). First, it concerns the extent to which training programmes and skill competence criteria are dominated by abstract theoretical knowledge and organized around intellectual boundaries and concepts rather than practical problems. An education system characterized by a high degree of abstraction of knowledge and an academic orientation generates a narrow conception of 'knowledge' and recognizes only its theoretical component as a basis of expertise and qualification. Expertise acquired through this kind of education system tends to be highly specialized and distant from problem-solving practices. It leads to a dominance of explicit over tacit knowledge, and the adoption of a deductive approach to problem solving. Holders of such academic credentials will also seek to legitimate their positions in organizations by drawing a clear boundary between 'theory' and 'practice', and by distancing themselves from those engaged in practical problem solving. In contrast, a system that combines formal education with practical experience fosters a broad conception of 'knowledge'. Knowledge, in such a context, is based not only on formal theory acquired through study, but also on practical skills and experience accumulated in work-related contexts. In other words, the system sees both formal knowledge and practical skills as equally important for the competent performance of tasks. This reinforces a close working relationship between

different categories of the workforce and promotes cooperative team working.

The second aspect of formalization is associated with the extent to which formal education institutions and professional bodies control the nature and content of high-level expertise. Generally speaking, increasing levels of control by formal education and professional institutions are associated with increasing formalization of knowledge in training programmes. This is because the training programmes become structured around academic conceptions of expertise derived from intellectual and scientific objectives constructed outside the work context, rather than problem-based techniques. Hence, the knowledge acquired is more standardized and codified; it can be bundled into specific occupations with clearly defined knowledge and role sets. A market-based employment system (OLM) is associated with a higher degree of academic and professional control over skills formation and hence a greater degree of formalization and abstraction of knowledge. In contrast, a firm-based system (ILM) is less constrained by such external control.

This leads to a third dimension: the extent to which academically developed and certified expertise monopolizes high-status and well-rewarded jobs. The degree of 'professionalization' of expertise reflects this. The Anglo-Saxon model of 'professionalism', for example, depicts a close connection between theoretical knowledge and elite status (Glover 1978). It is characterized by the organization of occupational expertise around academic specialization, assuming a one-to-one connection between a body of abstract knowledge and an occupation. The body of formal knowledge becomes a basis of competence and jurisdictional control over task boundaries. This has resulted in a proliferation of occupations based on narrow academic specialization. Formal knowledge thus becomes a tool for status differentiation and a basis of claims for control (Gerpott and Domsch 1985). The professional model of skill formation plays down the practical and tacit components of knowledge (Kerr and Von Glinow 1977). It is associated with the development of a hierarchical pattern of work organization. Child et al. (1983) argue that the notion of 'professionalism' in Britain has led to the low status of production. The tacit and contextual nature of the skills underlying production makes it difficult for the job-holders to demonstrate that their work has a clearly defined 'knowledge base'.

Degree of Academic Bias and 'Elitism'

An education and training system characterized by a strong academic orientation, but which attaches little importance to the general education and vocational training of the majority of the workforce can be described as 'elitist'. An elitist system is characterized by a highly uneven, two-tier distribution of competence: a well-developed higher education system for the elite, while the majority of the workforce is poorly educated. For example, the systems in the United Kingdom and United States can be described as 'elitist'. They display a strong bias towards academic education and attach little social status and economic credibility to practical skills, which acts

as a disincentive for investment in this area. As a result, there is a widespread lack of formal intermediate skills and qualifications among the general workforce in these two countries (Buechtemann and Verdier 1998; Lynch 1993; Finegold and Soskice 1988; Prais 1993). Such an elitist system creates a bias in the use of human capital and labour market polarization (Foray and Lundvall 1996; Lundvall 1997). It is associated with a bureaucratic form of work organization and knowledge configurations within firms. The wide disparity in the educational backgrounds and skill levels between the different categories of the workforce generates knowledge discontinuities and social distance within firms. It reinforces the domination of formal knowledge over tacit skills and generates a hierarchical pattern of work organization.

In contrast, a broad-based education and training system recognizes the value of both academic education and vocational training. It is characterized by a widespread and rigorous general and vocational education for a wide spectrum of the workforce. Such a system is more conducive to a decentralized mode of work organization. A more even distribution of competence among the workforce provides a better basis for interactive learning and the cultivation of tacit knowledge as a source of organizational capability. The cases of Germany and Japan are illustrative (Soskice 1996; Aoki 1988; Koike 1986 and 1995). The systems in these two countries accord relatively high social status to 'practical experience', and recognize it as a source of competence and qualification. This encourages investment in vocational training which has resulted in a good supply of intermediate skills. This enables firms to organize work in a more cooperative and decentralized manner, conducive to the transmission and mobilization of tacit knowledge.

Labour Markets: Careers, Identity and Learning

Labour markets and the nature of employment relationship influence the knowledge base and learning capabilities of the firm in three main ways. First, these determine the extent to which expertise is developed outside or within the firm, and hence the relative importance of formal education and training institutions *vis-à-vis* employers in defining the knowledge base of the firm. Second, they determine career mobility and incentives for individual workers and the capability of the firm in acquiring and accumulating different types of knowledge. And third, they shape the individual's career and social identity and define the boundaries of learning.

Occupational Labour Market (OLM)

An occupational labour market (OLM) offers a relatively high scope for job mobility. Knowledge and learning are embedded in an inter-firm career. A large part of the knowledge and skills required are developed outside the firm, or within the firm, but according to inter-firm occupational standards. Formal education and training play a much greater role in generating directly relevant occupational competence, and hence exert a direct influ-

ence on the knowledge base of firms. The type of qualifications generated can be highly task-specific, based on standardized, advanced 'packaging' of knowledge and skills (e.g. craft-oriented training or professional education). Alternatively, it can be a broad-based general education providing the 'meta-competences' that can be adapted and applied across a wide variety of work settings and tasks (Nordhaug 1993). The former approach assumes that the task environment is relatively stable and the knowledge required can be codified and pre-packaged in initial training programmes. The latter, in contrast, rests on the notion that the task environment is uncertain and the knowledge required is fluid and emergent. It cannot be easily bundled into occupations or codified in advance, and hence requires a broad-based initial qualification to enable individuals to pursue a more varied and flexible approach to continuous learning.

In an OLM, knowledge and skills are owned by and embodied in the individuals; they are personal properties for career advancement. The transparency and transferability of the knowledge acquired is of paramount importance for inter-firm career mobility. Such career mobility relies on effective signals: dependable information about the type and quality of skills and knowledge that individuals have. This can be based either on public certification (institutional signals), or peer group recognition (information signals). The former approach works well, provided that the knowledge and skills required can be easily identified and codified, i.e. bundled into specific occupations with a distinctive set of tasks or problems to which these skills and knowledge are applied (Tolbert 1996: 336–337). In situations where the tasks are highly fluid and unpredictable, and the knowledge used constitutes a large tacit component, institutional signals become insufficient and unreliable. This is because tacit skills cannot be easily codified; they can only be revealed through practice and work performance. Their transfer will have to rely heavily on social and professional networks based on shared industrial or occupational norms. In other words, the efficient transfer and accumulation of tacit knowledge in an OLM requires the support of a 'containing social structure', for example, the formation of a community-based OLM based on localized firm networks and industry clusters (Defillippi and Arthur 1996; Saxenian 1996). Social networks facilitate the 'marketability' of cumulative personal tacit skills.

Learning within an OLM tends to be person-centred and market-oriented. It is rooted in the individual's professional and career strategy, and characterized by a greater degree of autonomy and latitude in the boundary and domains of learning. Learning may occur not only within the confines of the firm and the groups and networks attached to the firm, but also within the individual's professional and social networks which extend beyond the firm (Bird 1996). This can potentially enlarge the knowledge base of the firm. Moreover, firms operating in an OLM can add variety and diversity to their knowledge base through external recruitment. The greater degree of mobility in the labour market allows firms to align their knowledge base closely with shifting market requirements and technological changes.

Internal Labour Market (ILM)

Internal labour markets are characterized by long-term stable employment with a single employer and career progression through a series of inter-connected jobs within a hierarchy. Knowledge and learning are embedded in an intra-firm career; a large part of the knowledge and work-related skills is generated through firm-specific on-the-job training (OJT). Formal knowledge acquired through education serves only as an entry qualification and provides the basis upon which work-related skills are built within the firm. OJT thus plays a critical role in defining the knowledge base and learning capabilities of firms operating an ILM. There are two alternative ILM models: narrow jobs and stratified careers vs. broad-based jobs and continuous careers. The former is associated with an elitist education system, and the latter, with an egalitarian one.

Where jobs are narrowly defined and careers are organized around hierarchies of jobs with tiered boundaries based on formal entry qualifications (e.g. upper-tier work associated with formal knowledge learned through higher education, as in the case of France), OJT will tend to be narrow and job-specific, and the opportunities for career progression based on OJT will be limited. Narrow OJT reduces the variety of the individual's experience and hence limits the scope for creative thinking and the generation of tacit knowledge (Nonaka 1994: 21). The containment of learning within a single job prevents the creation of common understanding and knowledge integration. Moreover, the association of formal knowledge with higher positions implies that tacit skills accumulated through practical experience will be under-valued and not recognized as a basis for promotion. The incentives for individuals to accumulate such knowledge are weakened and the organization fails to exploit the potential of 'learning-by-doing'. An ILM based on narrow job specialization and a career structure characterized by clear tier boundaries generates a fragmented and hierarchical knowledge base.

In contrast, an ILM can also be organized around broadly defined jobs and a continuous career hierarchy based on a common ranking system (e.g. the case of Japan). Progression to upper level positions is achieved, in this case, through accumulation of a wide range of skills and organizational experience. Formal knowledge plays only a limited role in defining competence criteria and entry to senior positions; the key emphasis is on the long-term accumulation of firm-specific skills and practical experience. OJT is broad-based and linked systemically with career progression. Broad-based OJT increases the variety of experience and facilitates the generation of tacit knowledge. Job rotation also serves an important socialization function and helps to reduce social distance between different categories of the workforce. The close integration of OJT with career progression also gives individuals a strong incentive to accumulate knowledge through practical experience. The career hierarchy becomes a device for tacit knowledge creation and learning.

Learning within an ILM tends to be organizational-oriented and self-reinforcing. It evolves along the internal requirement of the firm, and is rooted

in a firm-based career and organizational identity. The stability of personnel within an ILM facilitates the retention and accumulation of knowledge. Organizational memory becomes an important source of learning (Huber 1991: 105). It allows firms to exploit their knowledge base on a continuous basis, linking their past and present activities and extending them to future possibilities (Hamel and Heene 1994). Firms may display a strong capacity for incremental innovation, focusing on developing a distinctive core competence (Prahalad and Hamel 1990; Leonard-Barton 1992). The career structures that encourage social identification, however, may also reduce the firm's capability to learn from individual deviance and inhibits the insertion of radical skills.

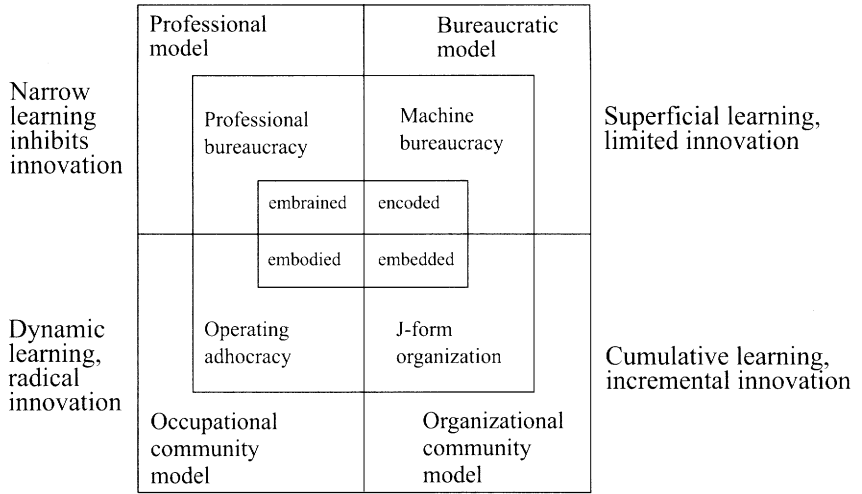
Four Contrasting 'Societal' Models of Knowledge and Learning: The Role of Tacit Knowledge and Innovation

The interaction between education and labour market institutions gives rise to four contrasting institutional configurations underpinning the different organizational forms and knowledge types discussed in the earlier part of the paper. These institutional configurations can be taken to represent different 'societal' models of organizing knowledge and learning: the 'professional', 'bureaucratic', 'occupational community' and 'organizational community' models (see Figures 3 and 4). Their effects on the learning and innovative capabilities of firms are mediated through the different organizational forms. The term 'societal' requires some qualification. It is used in a broad sense to point out the effect of institutional environments on ways of organizing knowledge and learning, rather than simply to emphasize national distinctiveness. The institutional environment may exist at the societal, regional or sector levels. Although dominant models may exist in countries, it is also possible to find a variety or mixture of models in the same country. The four contrasting 'societal' models described below are archetypes, not country 'averages'.

The Professional Model

The professional model is characterized by a narrow, elitist education based on a high degree of formalization of knowledge. It is rooted in an open labour market based on a high level of occupational codification and specialization. The system is geared to the generation of explicit knowledge and favours an individual approach to learning; the incentives and social structure required for the diffusion and accumulation of tacit knowledge are relatively weak. The professional model gives rise to the dominance of the 'professional bureaucracy' and 'embrained knowledge' within firms. It prevails in countries where the notion of 'professionalism' is deeply rooted in the fabric of societal institutions, such as Britain and the United States. The professional model generates a narrow approach to learning and inhibits innovation.

Figure 4
Knowledge,
Organizations and
Institutions: Three
Interlocking
Levels



The Bureaucratic Model

The bureaucratic model shares many common characteristics with the professional model on the formal education and training dimension. However, it is rooted in an internal labour market organized around narrowly defined jobs and a tiered career hierarchy. These institutional features underpin the ‘machine bureaucracy’ dominated by ‘encoded knowledge’. Crozier’s (1964) portrayal of the French type of organization epitomizes this category. The bureaucratic model seeks to control and eliminate tacit knowledge. It generates a superficial approach to learning and has little capacity to innovate.

The Occupational Community Model

The occupational community model is rooted in a region-based OLM surrounding a cluster of interdependent occupations and firms. It is characterized by a high rate of inter-firm mobility which fosters the development of social networks and the transmission of knowledge. It provides an institutional framework and social infrastructure for tacit learning to emerge. The occupational community is an institutional prerequisite for fostering and sustaining the innovative capability of the ‘operating adhocracy’. In a ‘boundaryless’ open labour market, the operating adhocracy will be under pressure to bureaucratize because of the difficulties in accumulating and transferring tacit knowledge. The tacit knowledge-creating capability of the operating adhocracy can only be sustained if it operates as a member of a localized firm network. An archetypical example is Silicon Valley where a fluid, occupational labour market is embedded in a rich fabric of regional and professional networks (Rogers and Larsen 1984). Such networks of social relationships provide the ‘social capital’ and ‘information signals’ needed to ensure the efficient transfer of tacit knowledge in an inter-firm

career framework (Saxenian 1996: 36). The shared industry-specific values within the regional community ensure that tacit knowledge will not be wasted when one changes employers, and thus gives the individual a positive incentive to engage in tacit 'know-how' learning (Defillipi and Arthur 1996: 123). The occupational community also fosters the 'know-who' network that supports high rates of job mobility. Tacit knowledge is made visible through social reputation in a community-based OLM.

A community-based OLM creates a stable social structure within an open labour market. The inter-firm career mobility and social networks provide multiple learning opportunities which amplifies the learning and innovative capability of the firm. Learning is not confined within the boundaries of individual firms; it draws from the knowledge base of the community as a whole. The community's social and technical networks operate as a kind of super-organization, through which individuals and firms, in shifting combinations, engage in 'experimentation, entrepreneurship and interactive learning' (Saxenian 1996: 30).

The Organizational Community Model

The organizational community model is characterized by a broad-based education system and an ILM based on broadly defined jobs and a continuous career hierarchy. It favours the J-form organization typically found in Japan. The organizational community model generates a decentralized and cooperative approach to problem solving. It facilitates the transmission and accumulation of tacit knowledge through collective learning within a stable career hierarchy. It has a unique capability to generate innovation continuously and incrementally. Learning within the organizational community, however, is bounded within the firm-based ILM. This generates conservatism and inhibits radical innovation.

Two Alternative Models for Learning and Innovation

The above four contrasting 'societal' models illustrate the logic of institutionalized variation in the organization of knowledge and patterns of learning. The key factor that differentiates their learning capability is their ability to create organizational relationships for harnessing tacit knowledge. The analysis suggests that both the 'occupational' and 'organizational community models' are favourable to this. However, the different labour market structures generate some significant differences in their learning and innovation patterns.

The occupational community supports the operating adhocracy, and the organizational community, the J-form organization. The individuals enjoy a much greater degree of autonomy in the operating adhocracy; their careers and social identity are rooted in the wider occupational community. In contrast, the J-form organization emphasizes the close integration of the individuals into the organizational community. These differences are reflected in their dominant knowledge types and learning patterns. The operating

adhocracy derives its capability from the knowledge and skills embodied in the individual experts. It is a 'knowledge-intensive', market-based organization focusing on the strategic advantage of continuous change, adaptation and entrepreneurship. In contrast, the J-form organization draws its capability from the collective knowledge 'embedded' in the organization's routines and shared values. It adopts a firm-centred approach to learning. It is a 'knowledge distributing' organization, depending on the collective competence of its members. It derives its competitive strength from the cultivation of firm-specific core competence. The contrasting strategies adopted by the two models generate different types of organizational capabilities and innovation patterns. The occupational community model facilitates the diffusion of tacit knowledge within a broader boundary and varied contexts. It encourages experimentation and entrepreneurial behaviour and has the potential to achieve radical innovation. The organizational community model, however, allows the accumulation of tacit knowledge within the boundary of the firm. It has the capacity to enhance its knowledge base through internalization and absorption. It is geared to incremental innovation.

Despite these differences, the two models share an important common feature: the role of tacit knowledge in generating learning and innovation within 'communities-of-practice' (Brown and Duguid 1991), albeit on a different scale. They suggest that learning and innovation cannot be separated from social interaction and practical experience, both of which are vital processes for tacit knowledge creation.

Conclusions

This paper has illustrated the coherence and interdependence between the three levels of analysis: the cognitive, organizational and societal, and provides a theoretical framework for understanding the role of tacit knowledge in organizational learning. It argues that knowledge configurations of firms and patterns of learning cannot be separated from specific organizational forms and institutions. Although the recent literature has stressed the importance of tacit knowledge in organizational learning and innovation, it has neglected the role of institutions in shaping this. The 'national innovation system' literature has tended to focus almost exclusively at the macro level, expressing the role of tacit knowledge in intuitive terms without showing how it articulates within different organizational and institutional structures. The organizational learning literature, in contrast, has tended to look exclusively at processes within organizations to the exclusion of their institutional context. The framework developed in this paper provides a bridge linking the two contrasting strands of analysis.

The four-fold typology developed in the paper illustrates the logic of institutionalized variation in organizational learning. Such typologies are useful, in so far as one does not treat them as descriptive models for making unqualified generalizations about specific countries. While specific societal

modes of organizing knowledge and learning do exist, societies do not usually fall unambiguously into one of the four types. Putting aside the 'societal specificity' debate, a more fruitful line of enquiry would be to explore how such institutionalized variation may allow, or constrain, firms and countries in creating different organizational forms needed for generating the types of innovation associated with different technologies or industrial sectors. In this manner, the framework proposed in this paper holds promise for generating new insights into the notion of 'societal strategic advantage' (Sorge 1991; Biggart and Orru 1997) in the context of learning and innovation. At a more practical level, it offers an analytical framework to capture the policy concerns of what Lundvall and Borrás (1997) have described as a 'learning economy'.

Note

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