Codification of Tacit Knowledge for the New Learning Economy

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This paper outlines the concern in the new learning economy for the codification of knowledge, arising from the recognition of the importance of knowledge in future competitive economic activity and the short-lived nature of the knowledge which is involved in innovation. It relates this concern to previous managerialist assumptions about the nature of education and the knowledge evident in such movements as competency-based training. The nature of the sought codification, the kinds of knowledge involved, the challenges of codification, and the feasibility of the new calls for the codification of tacit knowledge are examined. It is concluded that it is doubtful that tacit vocational knowledge can be codified, transmitted and grafted as intended for innovation in rapidly changing workplaces.

Learning economies are regarded as those which can Marshall and share expertise as industries become more knowledge-intensive in pursuit of continuous innovation for profit maximisation. According to Lundvall and Borrás (1997, p. 30) in their report for the European Union:

the notion “knowledge-based economy” draws attention to the fact that since the post-war period the production process has increasingly relied on knowledge-based activities. The proportion of labour that handles tangible goods has become smaller than the proportion engaged in the production, distribution and processing of knowledge. The expansion of the “knowledge-intensive” sector vis-à-vis other routine and physical production processes seems to be one of the major trends in economic development in this period. We shall go on to argue that it is better to talk about ‘a learning economy’ than a “knowledge-based economy”, since the high pace of change means that specialised knowledge becomes much more of a short-lived resource, and that it is rather the capability to learn and adapt to new conditions that increasingly determines the performance of individuals, firms, regions and countries. According to this report, in "the learning economy crucial elements of knowledge remain specific and tacit, and rooted in specific organisations and locations".

The distinction between tacit knowledge and codified knowledge is important because, if knowledge remains tacit, it flows less easily across organisational and geographical borders. If all knowledge were readily transformed into information to which everyone had easy access, there would be little incentive for firms, regions and nations to invest in R&D and technology gaps between regions and countries would be minor and temporary. Basically, knowledge remains tacit if it is complex or variable in quality: in situations where several different human senses need to be used at the same time, when skilful physical behaviour is involved and when understanding social relationships is crucial. This is especially difficult to overcome when the context undergoes rapid change. (Lundvall & Borrás, 1997, p. 13)

Codification Agendas in Retrospect
Against the explicitness of the new economic conceptions of education and knowledge, the
competency-based training movement can be seen as continuing attempts to codify vocational knowledge. Communication from industry to educators about what competence should be developed in vocational education is mediated by language in the form of standards and learning outcomes. For transmission, workplace competence is codified, as verbal descriptions. The early moves in competency-based training involved verbal descriptions of expected behaviours (The National Training Board, 1990). The narrowness and specificity of such capacities became apparent to policy-makers and these behaviours were then differentiated using such verbal descriptions as those involving tasks, management of groups of tasks, contingency management and job/role environment skills (National Training Board, 1992, p. 29). It was eventually also recognised that such behaviour required "underlying knowledge". And, eventually, these behaviours and implicit underlying knowledge were supplemented with Key Competencies (Mayer, 1992), an attempt to codify that which is perceived as generic or transferable across different kinds of work. These are problem-solving; collecting, analysing and organising information; using technology, using mathematical ideas and techniques, working with others and in teams, planning and organising activities, communicating ideas and information. Attempts are currently being made to codify and disseminate vocational competence in "training packages".

The emphasis on such codes appears to arise from their commercial importance in managing knowledge: eg codes are needed to derive and transmit the nature of the required outcomes, to assess whether they have been achieved, to purchase clearly delineated training, to manage trainers and their efforts, to appraise different providers in a competitive market, to pay workers, and so on.

**Knowledge to be Codified in the New Codification Agenda**

Lundvall and Borrás (1997, p. 46) outline the kinds of knowledge to be codified for the new learning economy, and suggest how this codification might take place. They also outline the kinds of processes of interaction that already lead to the acquisition of such tacit knowledge.

Codification of knowledge implies that knowledge is transformed into 'information' which can be easily transmitted through information infrastructures. It is a process of reduction and conversion which renders the transmission, verification, storage and reproduction of knowledge especially easy. (Lundvall & Borrás, 1997, p. 31)

The classical examples of tacit knowledge quoted in the literature are typically individual skills (like cycling and swimming) that cannot be made explicit and that cannot be transmitted through, for instance, telecommunication networks. But, it is interesting to note that this and other kinds of tacit knowledge closer to the economic process, such as management skills and economic competence, can be learnt. They will typically be learnt in interaction with other people, through a master apprentice or collegial relationship. This means that tacit knowledge can be shared through interaction and co-operation. Simple forms may be accessed through imitation of behaviour, but in most cases learning is greatly facilitated if the master or colleague co-operates with the apprentice... (p. 46)

On completion of a specific project people and organisations that solve problems together will typically, as an end result, now share some of their partners' original knowledge, as well as some of the new tacit knowledge produced by the interaction. Interactive learning is the key to sharing tacit knowledge, which means, of course, that the social context is important for this kind of learning — an observation which we shall discuss in more detail later. (p. 46)

The report extends the ideas of tacit knowledge beyond the individual to the organisation and to networks of organisations. It recognises that the codification of such knowledge is static and can lose its meaning through the process of describing it in verbal terms.

Tacit knowledge is not to be found only at the level of the individual. An organisation,
with its specific routines, norms of behaviour, codes of information etc. may be regarded as a unit that carries within it knowledge, a substantial part of which is tacit. Management may, from time to time, make attempts to codify everything constituting the organisation — perhaps in order to make it less vulnerable to the risk that key persons leave the organisation — but, if they are realistic they will realise that it can only be done in a very simplistic and static environment and that the efforts involved may bring the organisation in a standstill while the rest of the world keeps moving... (p. 46)

Even industrial networks and inter-firm cooperation arrangements may be seen as repositories of tacit knowledge layered into common procedures and codes not reflected in formal contracts or other documents. Some of these procedures might be possible to codify while others would lose their meaning if they were written down. (Playing golf, drinking cocktails, flirting with professionals from another organisation, and sharing political, religious and literary tastes, may be fundamental in bringing people from different organisations together in projects of interactive learning but they do not look impressive on paper and they undermine their own function if they become part of an explicit and purely instrumental strategy.) This is a problem similar to the formation of trust in a market economy. (p. 46)

Assumptions About Knowledge and the Individual Underlying the Codification Agenda

Such a codification perspective takes knowledge as an entity that comes in parcels. These parcels can be developed and traded, provided they can be adequately represented in codes, usually verbal. In a global economy they can be traded across geographic boundaries, and the knowledge can be fed into activities at sites independent of some individual who may possess the knowledge. This perspective is less concerned with individuals per se. It is concerned with feeding codified knowledge into the development of new economic entities, and achieving this as independently of individuals, locations and time, as possible.

Previous attempts at describing skilful practice as competencies, and generalisable abilities as key competencies are predicated on the idea that skills, creativity and other complex human behaviour can be described, developed and traded. Herein lies the economic problem of tacit knowledge — it seeks to separate the individual and the setting from knowledge. In order to be traded as an economic good, this knowledge needs to be codified so that it can be bought and applied in innovation like any other good. Just as individuals are no longer needed to operate machines in manufacturing, it should not be necessary for the individual who develops new knowledge to be directly involved in innovation — just codify and trade the knowledge. Yet continuing attempts to treat vocational knowledge in this way have not been successful in generating economic wealth and overcoming societal problems like youth unemployment and equity.

This perspective leaves the individual aside. It is not concerned with individuals’ callings, ways of constructing meaning, and societally appropriate practice, or the culture of practice, than with immediate and on-going human capital, mobilisable in a globalising economy. Rather it seeks to rely on the mobility of knowledge instead of the thinking individual working in a setting as the primary source for innovation. It is opposed to ideas which give pre-eminence to the individual: ideas of individual development, empowerment, or criticality (except as they might relate to generating codifiable products related explicitly to economic ends); or continuity in meaning between work and other aspects of life and society (e.g. see Stevenson, 1993, 1994a, 1996a). The view separates knowledge for work from knowledge for other life purposes.

The Nature of Vocational Knowledge

The research literature has also long recognized such phenomena as tacit knowledge
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(Polanyi, 1967), implicit knowledge (see Buchner, Funke & Berry, 1995; Long, 1995), multiple intelligences (Gardner, 1983), non-traditional intelligence (Stenberg, 1985) and the plurality of representational encoding and memory systems (Martin, 1993; Paivio, 1979; Tulving, 1984).

Contrary to its current economic recognition, tacit knowledge has usually been undervalued in academic work. Psychology has "avoided studying practical, sensory activity... (where) external activity... was viewed only as expressing the internal activity of consciousness." (Leont'ev in Wertsch, 1981, p. 51). Academic work has separated that knowledge which can be described in verbal terms from that knowledge which cannot. Thus we have disciplines of knowledge, called theory, which is taken to provide the underpinning conceptual understanding needed for action. It is presumed that, if only this verbally expressible knowledge could be acquired, then individuals could engage in generative and productive activity that is conceptually-driven. It is this conceptually-driven capacity to represent new problems that is taken by cognitive psychology to be the expertise that develops with experience in practice and which differentiates novices from experts. Non-linguistic knowledge is still often seen as "intuitive", "primitive", or even misconceived (e.g. see the discussion by Schnotz & Preuß, 1999), rather than as "task-dependent constructions" (Schnotz & Preuß, 1999). These ideas persist despite Ryle's (1949) powerful arguments against this separation of "head" and "hand" or knowledge "that" and knowledge "how". A higher value is afforded that (theoretical) knowledge which is abstracted from the concrete or particulars of a situation and organized into disciplines of knowledge ("theory"), over that knowledge which enables activity or practice. It persists as a primary differentiating feature of "vocational" vs. "higher" education / knowledge, or "general" vs. "vocational" education / knowledge, or "theoretical" vs. "applied".

There is now considerable research to challenge the confounding of knowledge with its verbal renditions. We now realise that people know in a variety of ways, none of which is intrinsically superior. Verbal concepts are but one kind of symbolisation (Nunes, 1999), and concepts are "intrinsically linked to practical and physical skills (Säljö, 1999, p. 83). Conceptual change may "not necessarily involve the replacement of one kind of representation with another, but the coexistence and integration of different representations for different tasks" (Pozo, Gómez, & Sanz, 1999, p. 163). Some examples of the problems of verbal representations follow. Boshuizen and his colleagues (1995) found that discipline-based verbalizable medical knowledge is transformed qualitatively in practice. Bloch (1998) concluded from his anthropological studies that language appears to play only a small role in the transmission of complex, everyday and practical knowledge. He argues that "under certain circumstances, this non-linguistic knowledge can be rendered into language and thus take the form of explicit discourse, but changing its character in the process" (p. 7). Practical skills are better transmitted non-linguistically to save double transformation into and out of language. For Bloch, the nature and form of expert knowledge for everyday purposes appears to be more related to how the knowledge is used than how it may be elaborated as semantic conceptual schemata like those found in scientific texts.

The "selection and organization of knowledge" is influenced by the "modality in which objects are most frequently encountered" (Scribner, see Tobach et al., 1997). The development of expertise consists in "becoming socialized into a specific view of the world" (Haldén, 1999, p. 55). From studies on the acquisition of blacksmithing knowledge, Keller and Keller (1996) suggest that "knowledge is organized for doing rather than abstracted into various formal arrangements on purely logical or typological grounds". The interaction between knowledge as language and knowledge as action, in expertise and its development, has been exemplified and detailed in Hutchins' (1995) detailed exami-
niation of the collective nature of cognition as a crew overcomes the failure of navigational equipment as a ship enters a harbour. From the work of such authors as Scribner (see Tobach et al., 1997), Engeström (e.g. 1999, p. 66), and Keller and Keller (1996) we also have considerable clarification of the role of artifacts and the culture that generates and surround them, in practical thinking. The conceptual change literature (e.g. Schnitz, Vosniadou, & Carrereto, 1999) also now draws on Vygotsky's idea that concepts originate in human practice. This recent literature brings together such findings as the role of concepts in helping us to categorize, engage in concrete practical action and skill; and that they should not be considered as separable from action; or from practice. It confirms that conceptual change does not necessarily replace everyday constructions of knowledge, and may well result in syntheses of different kinds of representations. Different representations compete for activation in different situations and for different tasks. While some of this literature still gives a special place to language: in the labeling of categories, which explain regularities in the world; in the expression of concepts; and in communicating knowledge, verbalized concepts are regarded as just propositional representations alongside other kinds of representations.

There are therefore considerable challenges to a codification of vocational knowledge. From this work and work in the Centre for Learning and Work Research (Beven, 1997; Stevenson 1996), the nature of vocational knowledge challenges for codification can be summarised as follows.

(a) The capacity to perform is situated and effectively depends on the context of the culture and the context of the situation:

- Mediating tools and workplace artifacts
- Capacity to make predictions and inferences based on rules known only to participants
- Complex systems of pathways
- Capacity to interpret (decode and analyze)
- Inter-relationships - task, self, others and mode

(b) The situated capacity to perform is normative; it involves value judgements and reconciliation of various value positions. These values are derived from a variety of sources.

(c) Tasks usually require a mix of attributes across subject areas

(d) There are serious limitations for transfer from/to superficially similar situations even within the same broad work function in the same industry

(e) While verbal labels can be assigned to knowledge this labeling is somewhat arbitrary, when selecting a level of generality to capture the construct. In choosing a label, one can go to existing taxonomies or construct one derived from features of the workplace, its functions and activities that go on within it. In either case, verbal descriptions are limited in their capacity to reproduce the schemata that are presumed to comprise productive and generative activity.

(f) The more abstract the label, the more removed from meaningfulness in actual concrete practice; knowledge in action is highly contextualized and situation-dependent

Conclusion
Thus the assumption that verbal codes for knowledge can be developed as adequate representations of the knowledge that is actually represented in memory is rather problematic. As recognised long ago by Dewey (1916), there are intimate connections among knowledge, doing, purposes and functions, artifacts, tasks and settings. Recent research has teased out the complexities of these inter-relationships. There are therefore considerable challenges in seeking to codify vocational knowledge as tradeable parcels of knowledge in the way that economics demands. The very knowledge which the European Union report identifies as tacit — complex, variable, multi-
faceted, physical and social — is particularly difficult to capture verbally.

It is heartening to witness the re-evaluation of the worth of non-verbalisable knowledge, and the attention on tacit knowledge, but the assumption that it is codifiable suggests yet another confounding of knowledge with its verbal renditions. Rather, what is needed is a return to an emphasis on the learning individual, working in a setting with real physical and social characteristics. As Dewey recognised, because individuals seek to construct meaning in their work by building connections with other facets of their lives, their knowledge is idiosyncratic and highly situated. Since that time, it has been possible to add flesh to the complex nature of the schemata that are involved. It is therefore concluded that it is doubtful that it will be possible to graft onto individuals, the parcels of knowledge needed for innovation in rapidly changing workplaces.

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