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Tacit knowledge as a promoter of project success

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Abstract

This paper addresses the question of whether tacit knowledge can be an important contributory factor in the successful delivery of automation systems. The theoretical part of the paper deals with explicit and tacit knowledge, in particular with the essential nature of tacit knowledge and its manifestation in project activity. After this two related case studies are presented from the metallurgical industry. In the first case, the lack of tacit knowledge was an obvious reason for the poor economic performance of the project; in the second case, the value of tacit knowledge in the success of the project was probably significant. © 2000 Elsevier Science Ltd. All rights reserved.

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1. Introduction

It is often assumed that engineering knowledge can be encoded and stored within a narrow concept of information consisting of fully articulated and codified knowledge, such as blueprints, chemical formulae, or computer software (see for example Nonaka and Takeuchi, 1995). This information can be transmitted without loss of integrity of the message once the decoding rules are known. This way of thinking suggests that prevailing technology strictly defines the bounds of production and that anyone having access to this information can also operate production plants. It is assumed that no special training, know-how or experience are required. Another type of knowledge needed in engineering (tacit knowledge), has not received much attention. There is, however, evidence that the situation is slowly changing and the role of learning by doing, using and benefiting from the experiences of other firms is becoming acknowledged and being incorporated in engineering. The main idea is that these learning processes are partly based on tacit knowledge providing descriptive procedures on how to do something even if one cannot codify it easily or at all.

In the purchase and supply operations of companies, this bipartite nature of knowledge has probably not yet been sufficiently understood. In connection with project purchases, attention is directed at written material only. The fact that a great deal of the know-how required in the delivery is tied to knowledge that is not written but realised through the expertise and understanding of project personnel and various organisations, is not taken into consideration. This paper describes the presence and effects of tacit knowledge in the delivery of automation systems. Basing our study on action research, we show how the tacit knowledge of the project personnel can have a noticeable effect on the success of a project.

2. Theoretical framework

According to the theoretical framework of this research, knowledge falls into two different types: explicit knowledge and implicit (tacit) knowledge. However, several research traditions (for example the hermeneutic approach) stress the view that this type of direct division cannot be made and that one should rather take into account the existence and interaction of various types of knowledge.

2.1. Explicit knowledge vs. tacit knowledge

"Explicit knowledge is a type of knowledge which can be articulated in formal language including grammatical

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statements, mathematical expressions, specifications, manuals, and so forth" (Nonaka and Takeuchi, 1995, p. viii). Teaching and learning in schools occur through transfer and assimilation of explicit knowledge, whereas tacit knowledge is an entity that is both difficult to express and to define. The literature (see for example Polanyi, 1966; Johnson-Laird, 1987; Nonaka and Takeuchi, 1995) defines as tacit knowledge; beliefs, values, viewpoints, intuitions, uncodified routines, etc. In this paper tacit knowledge denotes intuition and commitment, both of which are obtained through the experience of the individual and the mental models formed through this experience. The following discussion describes the views of various researchers on these components of tacit knowledge.

2.2. Importance of experience

Badaracco (1991) claims that a human being cannot take advantage of information unless he/she has earlier 'social software' connected to that information. Also Cohen and Levinthal (1990), who introduced the 'absorptive capacity' concept, claim that man's capability of utilising new information in the solution of a task depends largely on his earlier knowledge. The fact that knowledge and know-how based on experience can be utilised in engineering is also supported by cognitive psychological research (see for example Ross, 1989). The results of these studies provide evidence for the role of specific, previously experienced situations in human problem solving.

The multi-faceted experience of an individual increases his/her possibilities of solving problems arising in a project. This is so because multi-facetedness adds to his/her ability to see subject entities and dependencies between matters. That is, the capability to solve a problem is dependent on the richness of the existing knowledge structure (Lyles and Schwenk, 1992). These observations, drawing on studies at the individual level in the cognitive and behavioural sciences, are supported by Bower and Hilgard (1981, p. 424) who claim that "…the more objects, patterns and concepts that are stored in memory, the more readily is new information about these constructs acquired".

Also the depth of knowledge and know-how may have a positive effect in the delivery of projects. In-depth know-how is especially necessary in a situation where a difficult technology-related issue poses a problem. That is, both the variety and depth of know-how are of help in solving project problems. Of these branches of experience multi-facetedness, which means, for example, the capacity to understand cause-effect relations, consists largely of hard-to-express tacit knowledge. In many actual cases the delivery of process automation systems have shown that there is much advantage to be gained from experience accrued from processes identical to those of the customer.

2.3. Mental models

Kim (1994) observes that mental models represent a person's view of the world, including both explicit and implicit (tacit) knowledge. Mental models provide a context in which to view and interpret new material. These models also help determine whether stored information is relevant to a given situation. They represent more than a collection of ideas, memories, and experiences. Kim uses a colourful metaphor in saying that mental models are like the source code of a computer's operating system, the manager and arbiter of acquiring, retaining, using and deleting new information. But they are much more than that because they are also like the programmer of that source code with the know-how (tacit knowledge) to design a different code as well as the know-why (explicit knowledge) to choose one over the other. Argyris (1989) argues that although people do not always behave congruently with what they say, they do behave congruently with their mental models.

2.4. Intuition

Intuition in engineering has recently received increasing attention and acceptance (see for example Nyström, 1993). Numerous studies show that experienced designers and project leaders rely heavily on intuition. This means that they do not figure out complex problems entirely rationally, relying instead on hunches (one type of tacit knowledge), recognising patterns, and drawing intuitive analogies and parallels to other seemingly disparate situations. (see for example Senge, 1990; Nyström, 1993). Very often, experienced designers have rich intuitions about complex systems, which they cannot explain in detail. Their intuitions tell them that cause and effect are not close in time and space, that some obvious solutions will produce more harm than good, and that short-term fixes very often produce long-term problems. But they cannot explain their ideas in simple linear cause-effect language or diagrams. They end up saying, 'Just do it this way. It will work.' For example, an experienced automation designer may, when dimensioning a process valve, come to a different solution from the one given in the manual. However, he may not be able to explain clearly why his solution is correct and functional and why the solution presented in the manual is incorrect. Also an experienced automation designer can often give a control loop correct parameter values without any cumbersome tuning of the loop.

2.5. Commitment

Badaracco et al. (1989) write that "…practitioners believe that people are motivated by self-interest and by a search for power and wealth". However, if it is assumed that people are motivated only by self-interest, then an