Tacit Knowledge as a Promoter of Success in Technology Firms

Kaj U. Koskinen
Pori School of Technology and Economics
Tampere University of Technology
P.O. Box 300, FIN-28101 Pori, Finland
Te. +358 2 627 2839, Fax. +358 2 6272727
Email. kajuk@pori.tut.fi

Abstract

In this paper we address the question of whether tacit knowledge can be a promoter of success in technology enterprises. Tacit knowledge is illustrated focusing on its foundations, on how it is expressed and how tacit knowledge can be utilised in technology firms. A model is presented by which the utilisation of tacit knowledge can be understood more profoundly. The question of how significant a role tacit knowledge plays in the formation of competitive advantage in technology enterprises is explored. Furthermore, the results of an experiment, in which the utilisation of tacit knowledge was estimated in ten small specialised supplier –type technology companies, are presented.

1. Introduction

Tacit knowledge represents knowledge based on the experience of individuals. It expresses itself in human actions in the form of evaluations, attitudes, points of view, commitments, motivation, etc. Usually it is difficult to express tacit knowledge directly in words, and often the only ways of presenting it are through metaphors, drawings and different methods of expression not requiring a formal use of language. On the practical level many experts are often unable to express clearly all they know and can do, and how they make their decisions and come to conclusions.

Polanyi [23] encapsulates the essence of tacit knowledge in the phrase "We know more than we can tell", and provides further clarification of the concept in such commonplace examples as the ability to recognise faces, ride a bicycle or swim without even the slightest idea of how these things are done. Rosenberg's ([25], p. 143) description of traditional technological knowledge, accumulated in crude empirical ways with no reliance upon science, provides a good definition of tacit knowledge in technology companies: "The knowledge of techniques, methods and designs that work in certain ways and with certain consequences, even when one cannot explain exactly why". Thus, tacit knowledge equals practical know-how.

Powerful comprehensive intuition is associated with tacit knowledge, along with a flexible ability to evaluate the knowledge and know-how required by the situation. Thus, tacit knowledge reinforces an individual's practical preparedness and allows concentration on the key activities of the task, since a part of the activity has become automatic through practice (Holma *et al.*, [15]). This kind of knowledge, quiet and non-verbal practical know-how, is difficult to study and define. Its structure is difficult to understand and therefore it cannot be fully comprehended or communicated. It is a question of knowing how complicated work situations should be managed and problems tended to.

However, in technology companies the significance of tacit knowledge has probably not yet been sufficiently understood. The fact that a great deal of the know-how required in the activities of a technology enterprise is tied to knowledge that is not written down in documents but realised through the expertise and understanding of the personnel, is not taken into consideration as a whole.

Tacit knowledge is acquired primarily through experience and therefore it cannot be communicated easily to others (Nonaka *et al.,* [20]). Thus, we conclude that in order for a technology company to be able to utilise its personnel's tacit knowledge, the personnel has to be committed to the tasks and goals of the company and has to have possibilities to transfer and receive that knowledge.

This paper has two goals; to illustrate factors promoting the utilisation of tacit knowledge in technology firms, and to explore how significant a role tacit knowledge plays in the formation of competitive advantage in such companies. Therefore the following discussion describes the views of various researchers on the above mentioned components of tacit knowledge and its utilisation, i.e. *the experience, commitment, and interaction of the people working for the company, and competitive advantage.*

2. Theoretical framework

2.1. Experience of the people working for the company

Badaracco [4] claims that a human being cannot take advantage of information unless s/he has earlier 'social software' connected with that information. Also Cohen *et al.* [9], 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/her earlier knowledge.

The multi-faceted experience of an individual increases his/her possibilities to solve problems arising in a task. This is so because multi-facetedness adds to the individual's 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 *et al.,* [19]). These observations, drawing on studies at the individual level in the cognitive and behavioural sciences, are supported also by Bower *et al.* ([7], 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 on the problem solving. In-depth know-how is especially important when the problem is a difficult technological issue. That is, both the variety and depth of know-how are of help in solving 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.

The importance of experience in engineering projects has been revealed in some empirical studies (e.g. Koskinen, [17]). The fact that project staff has earlier experience in the particular area involved in the engineering project has been demonstrated to be an important source from which to adopt the kind of tacit knowledge that can be used to benefit the present project.

Also intuition has recently received increasing attention and acceptance (c.f. Pihlanto, [22]; Cooper *et al.,* [10]). An expert behaves intuitively based on mental models (Johnson-Laird, [16]) derived from experience. These models are often founded on deep understanding based on explicit knowledge (Ståhle *et al.,* [29]; Cooper *et al.,*[10]). The elements of knowledge which form a stock of knowledge for the expert are so internalised and have been thought about so often from so many perspectives that the expert is no longer able to return them into individual details. For example, experienced designers have rich intuitions about complex systems, which they cannot explain easily in details. Their intuitions tell them that causes and effects are not simply in a reason-consequence dependency relationship and that obvious intuitive solutions will produce more good than harm. But they cannot explain their ideas in simple linear cause-effect language. They end up saying, 'Just do it this way. It will work.'

Personal experience (and tacit knowledge) can also be a factor in limiting learning. Path dependency (Teece *et al.,* [31]) means that the earlier history of an individual can limit his/her future behaviour. "Our experiences are not like water in glass which can be emptied and then refilled" (Flöistad, [12], p. 73). Thus, a person's knowledge and know-how are often bound to a specific context and era, and therefore they could be difficult to utilise in other enterprises and/or at other times and situations. Enterprises and the people that work for them should keep in mind that education and training often have a longer term effect than is at first planned for.

On the basis of the above discussion we can conclude that the quantity and the quality of the experiences of personnel determine the amount of tacit knowledge a technology firm has. However, the precise and direct measurement of such tacit knowledge is not possible.

2.2. The employees' commitment to the tasks and goals of the company

People can be bonded to the goals of a company by money, promotion, travel, etc. Several researchers (e.g. Senge, [27]; Leskinen, [18]) believe, however, that genuine bonding and commitment derive from interesting content of the work and from the goals of the job being significant. "If the work is valuable and the goals significant a person will endure dull stretches. In my opinion, it is not sufficient that the work is interesting, it must also be valuable" (Leskinen, [18]).

One of the most significant factors in commitment is motivation. Buchanan *et al.* [8] define motivation as an internal psychological process, which starts, re-enforces, directs and supports goal directed behaviour. For example, in engineering projects the question often is how to get people interested in the project and how to get them involved in dialogue. When during a project one speaks of motivation, one generally means how to keep a person's interest and how to keep him/her going ahead despite difficulties.

Gilley *et al.* [13] pay attention to the fact that it is important to the commitment of an individual that there exists interest in him/her as a whole person and not only as a resource experienced in his/her work. The manager of a company should know the families, hobbies, values, and other similar aspects about the personnel. Thus an employee's commitment to the enterprise could be increased.

On the basis of the above discussion we conclude that the commitment of an individual to the tasks and goals of a technology firm enhances his/her willingness to transfer and receive tacit knowledge.

2.3. Interaction between people working for the company

In order to benefit from tacit knowledge, one must be able to interpret, internalise, and understand different issues, circumstances, and situations. Therefore individuals working for a company communicate with each other by a number of different means, such as telephone, mail, electronic mail, and face-to-face conversations.

The richness of a communication medium can be analysed in terms of two underlying dimensions: the variety of cues the medium can convey and the rapidity of feedback the medium can provide (Daft *et al.,* [11]). Trevino *et al.* [32] propose a link between the selection of media and the ambiguity of the message to be conveyed. In situations characterised by a high degree of ambiguity, no established scripts or symbols are available to guide behaviour. "Meaning must be created and negotiated as individuals look to others for cues and feedback to help interpret the message" (Trevino *et al.,* [32], p. 557).

Berger *et al.* [6] argue that most experience of others takes place in face-to-face situations because the other person's subjectivity is available through a 'maximum of symptoms'; the here-and-now of each individual continuously impinges on the other, both consciously and subconsciously, as long as the face-to-face situation continues. The authors further argue that misinterpretation is less likely in face-to-face interactions than in less close forms of social relations.

On the basis of the above discussion we conclude that face-to-face interaction between people working for a technology firm enhances the utilisation of tacit knowledge in the company.

2.4. Model of the utilisation of tacit knowledge within a technology firm

According to the conceptual analysis above, we interpret the utilisation of tacit knowledge as being dependent on three main concepts:

1. *Experience.* Determines the quantity and quality of tacit knowledge. It also enhances the transferring and reception of new tacit knowledge. It is part of our *memory systems* (Baars, [3]).
2. *Commitment.* Commitment of the staff to the tasks and goals of the enterprise. This issue belongs to our *motivational systems* (Baars, [3]).
3. *Interaction.* Interaction of people within the company and with internal and external stakeholders. This subsystem has a reference to our *interpreting systems* (Baars, [3]).

The above mentioned aspects result in a three-dimensional space, represented by a cube (Figure 1.), in which the various people within the enterprise can be positioned in order to determine the amount of tacit knowledge utilisation within the enterprise.

Example 1, (see Figure 1., the staff of the company at point A). The company has a lot of relevant experience, and also the face-to-face communications opportunities within the staff and with the other stakeholders are good, but the staff's commitment to the goals of the company is weak. The result is that the whole tacit knowledge of the company is not used effectively.

Example 2, (see Figure 1., the staff of the company at point B). The company in this case has a lot of relevant experience and the staff's commitment to the goals of the company is strong. However, the staff of the firm are widely separated from each other and from the other stakeholders and therefore the amount of face-to-face communication is low. The result is that the whole tacit knowledge of the company is not used effectively.

Example 3, (see Figure 1., the staff of the company at point C). The staff is well committed to the goals of the enterprise and it has ample opportunities for communication with each other and with the other stakeholders. However, the personnel lack relevant experience and therefore the company may have difficulties meeting the goals of the enterprise.

Example 4, (see Figure 1., the staff of the company at point D). In this case the staff has a lot of relevant experience and it has good opportunities to communicate with other people within the firm and with the other stakeholders. In addition, the staff is well committed to the goals of the company. The tacit knowledge is maximally utilised in this case.

2.5. Competitive advantage and tacit knowledge

Tacit knowledge has been at the centre of the research into the competitive advantage of enterprises since its inception. There is evidence that the role of learning by doing and benefiting from the experiences of the personnel is acknowledged and incorporated in explanations of competitive edge (e.g. Teece, [30]; Teece *et al.,* [31]; Winter, [33], Nonaka *et al.,* [20]). The main idea is that these learning processes are partly based on tacit knowledge providing procedures on how to do something even if one cannot codify it easily or at all.

Several researchers (e.g. Alchian *et al.,* [1]; Nonaka *et al.,* [20]; Saint-Onge, [26]) consider that the competitive advantage of a firm is formed of the interaction between individuals and several types of knowledge. Thus, one firm might have more tacit knowledge than another firm. Alternatively there might be differences in the degree to which firms are able to absorb and apply explicit knowledge. Although advantage might accrue from any type of knowledge, the strategic implication of each, and the approach that the executives should take to the management of each, are quite different (Spender, [28]).

Teece [30] argues that if the firm's advantage is based on explicit knowledge, then its strategy must recognise that

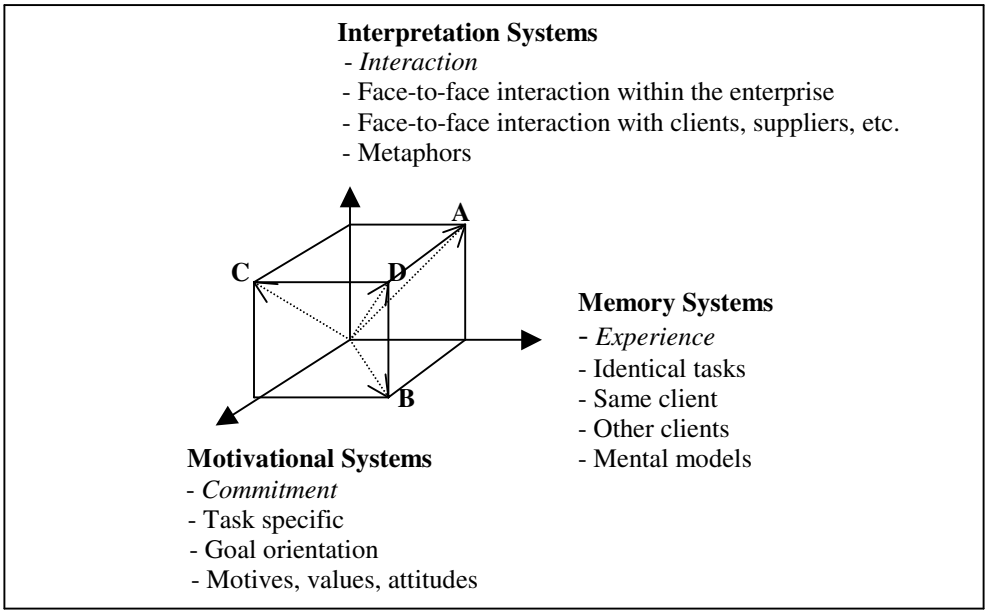

Figure 1. The utilisation of tacit knowledge within a technology company.

such knowledge tends to be professionally accessible and mobile. Appropriateness is likely to be a key issue, and patents, contracts and similar means regarding legal or institutional structures may or may not protect the advantage. The knowledge itself, and the ability to create similar knowledge through re-engineering or parallel research, is likely to be widely kept outside the company. If, instead, the advantage is based on an individual's tacit knowledge, such as industrial designing skills, then proprietary issues may be less important. Now the real problem is, according to Teece, to find ways of integrating this individual special knowledge into the rest of the organisation and with the complementary assets of the organisation, in order to generate the rent stream.

Reed *et al*. [24] describe how tacit knowledge, complexity, and specificity in a business enterprise form the complexity of functions that adds to the competitive advantage, which is hard for competitors to copy. These researchers assume that business enterprises are capable of distinguishing and also controlling factors generating competitive advantage like this. However, Hanan *et al*. [14] think that it is not possible to exactly evaluate and control the competitive advantage formed by soft assets, and therefore, they can neither be priced nor sold.

On the basis of the above conceptual analysis the following proposition is presented: Tacit knowledge can have a positive effect on the competitive advantage of technology firms. However, the existence of tacit knowledge in a company is often so much taken for granted, that its usage as a source of competitive advantage is not well realised.

3. Research methodology

The study is based on the idea that the competitive advantage of technology firms is derived from knowledge, and that knowledge, although not always so clear-cut, can be divided into tacit and explicit knowledge.

Basing our study on a conceptual analysis we illustrate tacit knowledge focusing on its foundations and on how it can be utilised in technology firms. The action research approach and experiment method are used to collect data in the empirical part of the study.

According to Olkkonen [21], concepts are by their nature abstract notations or symbols. With their aid we are able to solidify, structure and illustrate phenomena and their characteristics at a qualitative level. The results obtained through action research (Argyris *et al.,* [2]) are often new hypotheses or theories, explanations of change- or development processes, even normative instructions. The material and its processing are empirical, although the material is usually formed of a small number of cases.

In the opinion of Olkkonen [21], the problem of generalisation is related especially to the results obtained by action research. It remains to be contemplated as to what extent the results obtained in a limited number of experiments can be generalised to be applicable to a larger group. According to Olkkonen the results must be regarded as more or less probable hypotheses.

The research material based on the experiments must be chosen to best help the understanding of the research problem. According to Olkkonen [21] the experiment cases should be chosen, for example, by applying the following principles:

- Cases that can justifiably be regarded as typical with regard to the basic set
- Cases that represent examples of different types, in their typical form, in accordance with the preceding conceptual analysis and typeset
- Special cases, if it can be assumed that they reveal interesting and useful factors with regard to the research.

The enterprises included in this study represent the first principle of the above mentioned typesetting, i.e. the enterprises are specialised suppliers that are small technology companies producing product innovations that mostly enter other sectors. They work in close co-operation with their customers and embody a special type of knowledge that is partly tacit in the design and building of equipment (Bell *et al.,* [5]). Furthermore, in small technology enterprises the communication lines are short and the atmosphere is often free and non-bureaucratic, which factors are beneficial for tacit knowledge utilisation.

4. Empirical study

Ten small specialised supplier -type technology enterprises participated in the empirical part of the study. Three of the participating companies (Nos. 1-3 in Table 1.) were machine workshops, three (Nos. 4-6 in Table 1.) were electronic hardware manufacturers, and four (Nos. 7-10 in Table 1.) were software houses. The smallest firm consists of seven employees working for the company and the sales are 0.7 million US$. The biggest firm consists of 51 employees working for the company and the sales are 5.2 million US$ (see Table 1.).

The empirical study was divided into two parts:

1. Utilisation of tacit knowledge within the enterprise. An enterprise's utilisation of tacit knowledge was estimated according to the model laid out in Figure 1., by estimating three variables for each staff member. The utilisation of tacit knowledge in the whole business was obtained by totalling the individual employees' utilisation of tacit knowledge. The entire staff participated in this part of the study.

Experience. As mentioned above, tacit knowledge cannot be measured precisely and directly. Therefore it is necessary to estimate it indirectly, i.e. to operationalize the measured variable. The amount of tacit knowledge in a company was estimated by the relevant experience of each employee in the company.

In this part of the study each participating individual described his/her work history. Using these descriptions the author evaluated the amount of relevant tacit knowledge in the company. In the evaluation the author used as a criteria the contents and duration of the individual's earlier work experience as follows:

- S/he has worked in an area in which the firm's potential customers are operating
- S/he has been involved in the marketing of a firm whose target market was firms operating in an area where the present employer's potential customers are working
- S/he has been working in after sales services (maintenance) for a company whose target market is the same as the present firm's potential customers
- S/he has used the same kind of technology or the same type of device/service as the present enterprise is developing
- S/he has been involved in developing the same kind of technology or product/service as the firm is developing.

Each participating individual's relevant work experience was considered (although it does not belong clearly to a specific category) to belong to one or more of the above mentioned categories.

According to the above criteria the amount of relevant tacit knowledge possessed by an individual was estimated as follows: for each year of above mentioned work experience the person got one point. The length of the work experience is based on the conclusions made by the author when he interviewed the chief executive officers of the firms. According to the CEOs it takes a new employee from a few months to three years to become familiar with the products and production methods of the company.

In the company specific evaluations (Table 1.) each company was classified on a low/high scale. A company was classified as high, if it scored higher than (largest scored points of all participating companies – smallest scored points of all participating companies)/2 + smallest scored points of all participating companies. If the company scores less than or equal to (largest scored points of all participating companies – smallest scored points of all participating companies)/2 + smallest scored points of all participating companies, the tacit knowledge level was classified as low.

Interaction. In this part of the study, every member of the staff kept a log of all their communication (within the company and with the other stakeholders) for a normal working week.

According to the conceptual analysis above we can conclude that a person's opportunity to transfer/receive the tacit knowledge occurs mainly, when a person communicates face-to-face with another person. However, in this study it is concluded that also in communication by telephone an individual can transfer/receive some tacit knowledge.

On the basis of the above criteria a person working for a company was awarded points for the opportunities to transfer/receive tacit knowledge as follows: for each minute spent in face-to-face interaction the person got one

point and for each minute on the telephone, half a point. For participation in company sponsored leisure activities a person got three points. This is just a lump sum of points in a communication situation, where an individual interacts with other staff members without any goal connected to the work duties.

In the company specific evaluations (Table 1.) the following criteria was used: The amount of company interaction was classified on a low/high scale and the company was classified as high, if the point value was greater than (largest scored points of all participating companies – smallest scored points of all participating companies)/2 + smallest scored points of all participating companies. If the number of points is less than equal to (largest scored points of all participating companies – smallest scored points of all participating companies)/2 + smallest scored points of all participating companies, the amount of interaction was classified as low.

Commitment. A person's commitment to the tasks and goals of the organisation and thus to the transferring and receiving of tacit knowledge was studied through structured questionnaires for which the answers were set into a 5-point Likert-type scale. Every member of the staff except for the chief executive officer participated in this part of the study.

In the company specific evaluations (Table 1.) the same method as in earlier cases (i.e. experience and interaction) is used: Thus, the commitment of company staff was classified as high if the point value was greater than (largest scored points of all participating companies – smallest scored points of all participating companies)/2 + smallest scored points of all participating companies. If the number of points was less than equal to (largest scored points of all participating companies – smallest scored points of all participating companies)/2 + smallest scored points of all participating companies, the commitment of the staff was classified as low.

2. Tacit knowledge as a competitive advantage for the enterprise. In this part of the study each company's chief executive officer was interviewed. The goal was to explore his/her understanding of what was the firm's usage of tacit knowledge and whether tacit knowledge could function as a competitive advantage for the business. This part of the study was conducted with semi-structured interviews. In the following the questions used to direct the interviews are briefly described:

With the question *"Core competence of the business"* the author was seeking an understanding of what kind of knowledge was used in the company. When asking about core competence the author tried to avoid the terms tacit and explicit knowledge so that they would not direct the interviewees in their explanations.

With the two questions *"Learning about the company's products and work patterns by new employees"* and *"Imitation"* the author was trying to ascertain how significant the use of tacit knowledge was in the production of the company's products and services.

With the question *"The significance of tacit knowledge in the company's operations and product development"* the researcher attempted to clarify how significant tacit knowledge is in the company's various functions, *in the opinion of the chief executive officer.* The goal of this question differs from that of the first one in the chief executive officer now being asked directly about the use of tacit knowledge, whereas in the first question the amount of tacit knowledge was left to the author's interpretation.

With the two questions *"The company's competitive advantage"* and *"The effect of the staff's tacit knowledge on product pricing"* the researcher was trying to gain additional insight into the role of tacit knowledge in the formation of the competitive advantage of the company.

The empirical study was started by interviews of the chief executive officers. To start with the author explained to the interviewees the goal and the structure of the study. Furthermore, the interviewees and the author agreed that the interviewees should try to motivate the staff of the company to reply to the questionnaires.

5. The results

When clarifying core competence and tacit knowledge as a part of it in companies, the author concluded that in eight companies (80%) a significant amount of tacit knowledge was used in understanding the production and business processes of the customers. In five businesses (50%) the use of tacit knowledge was significant in designing and producing the company's products. In addition, the chief executive officers often stated (60%) that the production of products and services for customers required project management and group working skills which were partially founded on experience based tacit knowledge. There was not a single business where, on the basis of the interviews, the employees could function on the basis of experience based tacit knowledge alone.

When the chief executive officers estimated the time it took for new people recruited by the company to learn about its products and procedures, they meant persons employed in design and production. In most companies (90%) the respondents were of the opinion that what is most difficult to copy is the relationship between the company and its customers. These types of relationships have often developed over a long period of time and contain a great deal of knowledge in the form of tacit knowledge.

When evaluating the imitability of the company's products, 'product' meant a technical device or a computer program. The principal product of one company cannot be copied by another company since it is protected by a patent. In other cases the company's products can be coded into the form of explicit knowledge, and thus they can be copied by competitors. Still, according to the chief executive officers, competitors do not generally try to copy

Table 1. The results of the empirical study.

Firm	Personnel/ Sales (million US$)	Utilisation of tacit knowledge within the enterprise			Tacit knowledge used as a competitive advantage
		Experience Points(ind.)/Class	Interaction Points(firm)/Class	Commitment Points(firm)/Class	
No. 1.	51/5.2	2.6/High	473/Low	428/Low	Aware of
No. 2.	25/2.7				Aware of
No. 3.	9/0.7				Not intentionally
No. 4.	7/0.7	2.4/Low	589/Low	800/High	Not intentionally
No. 5.	14/2.3	1.5/Low	413/Low	350/Low	Not intentionally
No. 6.	25/1.7	2.0/Low	887/High	714/High	Not intentionally
No. 7.	12/1.0	2.8/High	518/Low	684/High	Aware of
No. 8.	13/0.8	2.0/Low	402/Low	325/Low	Not intentionally
No. 9.	18/1.2	2.8/High	761/High	849/High	Attempted
No. 10.	10/0.8	2.1/Low	549/Low	468/Low	Not intentionally

the product in question because the long product development process makes it uneconomical. Thus, even though the technology products of a company favour the use of tacit knowledge, it does not mean that a product could not be visualised if necessary.

When evaluating the significance of tacit knowledge in a company's operations and product development, four chief executive officers (40%) held that the use of tacit knowledge in marketing was very significant. Also four respondents (40%) said that the use of tacit knowledge in design and production was important. Only one (10%) held the opinion that the use of tacit knowledge was important in project management. The results obtained are in this case somewhat different from those obtained with the first question. It is, however, important to notice that to the interviewees the terms design, production, product delivery to customers, and project management, often meant very much the same thing.

When companies price their products, only rarely can they define precisely the benefits brought into the price by tacit knowledge. A small exception is found in custom deliveries, such as consulting services, when the work of a more experienced person in possession of more tacit knowledge is billed at a higher rate than the work of a less experienced worker.

In Table 1. a summary of the empirical results is presented. The personnel of enterprises Nos. 2 and 3 did not respond to the questionnaires. Maybe the reason for this was the fact that the chief executive officers of the companies were not able to motivate the employees to give a contribution to the study.

Utilisation of tacit knowledge within the enterprise.

Only one enterprise (No. 9) reached the value "high" with each dimension. Three enterprises (Nos. 5, 8, and 10) got the value "low" in all dimensions. On the basis of the interviews with the chief executive officers (c.f. section *Tacit knowledge as a competitive advantage for the enterprise)* the author expected that also enterprises Nos. 1 and 7 would have reached value "high" with all the dimensions, but the measurement of the staff's opinions gave another result.

Tacit knowledge as a competitive advantage for the enterprise.

Only in one enterprise (No. 9) the tacit knowledge was attempted to be utilised in order to improve the company's competitive advantage. This was, for example, done so that all the company's offers were signed by the three most experienced employees. Furthermore, only in that company an attempt to evaluate the significance of tacit knowledge as a promoter of the company's competitive ability was made in financial terms. Also in firms Nos. 1, 2, and 7, the general managers were aware that tacit knowledge is an important contributor in the formation of the enterprise's competitive advantage. However, in these companies there was no idea of how significant a role tacit knowledge plays in the formation of the firm's competitive advantage. In the other enterprises (Nos. 3, 4, 5, 6, 8, and 10) no attempt to evaluate the importance of tacit knowledge as a promoter of the firm's competitive success was ever made.

The results of the empirical research show that in four enterprises (40%) the management was confident that tacit knowledge has a positive effect on the competitive advantage of the company. However, only in one firm

(10%) tacit knowledge was consciously utilised for the advantage of the company. Probably this consciousness of the management is also the reason why interactivity and commitment of the staff are high in that company. *The result gives some support to the proposition.*

6. Discussion

Tacit knowledge cannot, as such, be measured, but it can roughly be estimated through the length and quality of staff experience. Therefore a misinterpretation of the test results regarding the amount of tacit knowledge is possible. The evaluation of staff communication is clearly more trustworthy than that of tacit knowledge. In this evaluation, however, some people complained about the amount of work involved in logging all communications and for this reason the results may be somewhat inexact. The results obtained from the evaluation of staff commitment are perhaps the most reliable of the measured variables.

One of the problems in the estimation of tacit knowledge as a competitive advantage was the attitude of the interviewees. Since the persons interviewed knew that the study related to experience based tacit knowledge, they tried to overemphasise the significance of staff experience as a factor in promoting a competitive advantage for the company.

7. Conclusions

The assessment of the utilisation of tacit knowledge in technology companies depends on the observer's interpretation and is therefore subjective. The utilisation of tacit knowledge cannot, therefore, be determined with scientific exactitude.

However, on the basis of this study we can draw a rough conclusion that tacit knowledge can be a promoter of success in technology firms. This is especially the case when small specialised supplier –type companies are concerned. However, the utilisation of tacit knowledge happens mainly unconsciously. There is, nevertheless, some evidence that if the technology firms tried to utilise their tacit knowledge consciously, they could gain more benefit from it.

Tacit knowledge as a source for competitive advantage exists in individuals in the form of experiences. Therefore, in order to grasp tacit knowledge, interaction between individuals is a prerequisite. What underlies such an interaction is independent, all-out commitment to the subject in question. Such commitment nurtures mutual trust which facilitates constant, quality dialogue and discussions.

The usefulness and utilisation of tacit knowledge always depends on the context and situation where it is used. Thus, future research on tacit knowledge should be directed, for example, at narrow branches of different business activities.

8. References

[1] Alchian, A., Demsetz, H., 1972. Production, information costs and economic organization. *American Economic Review,* 62.

[2] Argyris, C., Putnam, R., McLain, D., 1985. *Action Science: Concepts, Methods, and Skills for Research and Intervention.* Jossey-Bass. San Francisco.

[3] Baars, B., 1997. *In the Theatre of Consciousness*. Oxford University Press. New York, Oxford.

[4] Badaracco, J., L., 1991. *The Knowledge Link: How Firms Compete Through Strategic Alliances*. Harvard Business School Press, Boston.

[5] Bell M., Pavitt, K., 1993: Technological Accumulation and Industrial Growth: Contrasts Between Developed and Developing Countries. *Industrial and Corporate Change,* Vol 2.

[6] Berger, P., Luckman, T., 1966. *The Social Construction of Reality*. Penguin, New York.

[7] Bower, B., H., Hilgard, E., R., 1981. *Theories of Learning*. Prentice-Hall, Englewood Cliffs.

[8] Buchanan, D., Huczynski, A., 1997. *Organizational Behaviour. An Introductory Text.* Prentice Hall, London.

[9] Cohen, W., M., Levinthal, D., A., 1990. Absorptive Capacity: A Perspective on Learning and Innovation. *Administrative Science Quarterly*, 35(1), 128-152.

[10] Cooper, R., Sawaf, A., 1997. *Executive EQ.* Orion Books Ltd. London.

[11] Daft, R., L., Huber, G., P., 1987. How Organizations Learn: A Communication Framework. *Research in the Sociology of Organizations,* 5, 1-36.

[12] Flöistad, G., 1993. *Kunsten å omgås hverande* (The art of getting on with people). Ad Notam, Gyldendal.

[13] Gilley, J., W., Boughton, N. W., 1996. *Stop Managing, Start Coaching!* Irwin Professional Publishing, Chicago.

[14] Hanan, M., Karp, P., 1991. *Competing on Value.* Amacon, American Management Association, New York.

[15] Holma, A., Lappalainen, K., Pilkevaara, S., 1997. *Näkymätön näkyväksi –tieto, osaaminen ja Knowledge Management* (From Invisible to Visible -Knowledge, Know-how and Knowledge Management). Helsinki University of Technology, Espoo.

[16] Johnson-Laird, P., N., 1987. *Mental Models.* Cambridge University Press. Cambridge.

[17] Koskinen, K., U., 2000. Tacit knowledge as a promoter of project success. *European Journal of Purchasing & Supply Management* 6(2000) pp. 41-47.

[18] Leskinen, J., 1997. *Avoin, tasaveroinen keskustelu työpaikalla* (Open and Equal Discussion at the Work Place). Työturvallisuuskeskus. Helsinki.

[19] Lyles, M., A., Schwenk C., R., 1992. Top Management, Strategy, and Organizational Knowledge Structures. *Journal of Management Studies*, (29)2, 155-174.

[20] Nonaka, I., Takeuchi, H., 1995. *The Knowledge-Creating Company*. Oxford University Press, New York.

[21] Olkkonen, T., 1993. *Johdatus teollisuustalouden tutkimustyöhön* (An Introduction to the Research on Industrial Management). Helsinki University of Technology. Helsinki.

[22] Pihlanto, P., 1996. *Tieto laskentainformaation tuottajan ja hyväksikäyttäjän tajunnan ilmiönä* (Knowledge in the

Consciousness of the Producer and User of Accounting Information). Publications of the Turku School of Economics and Business Administration, Series A-8, Turku.
[23] Polanyi, M., 1966. *Tacit Dimension.* Doubleday & Co., New York.
[24] Reed, R., DeFilippi, R. J., 1990. Causal Ambiguity, Barriers to Imitation, and Sustainable Competitive Advantage. *Academy of Management Review,* Vol. 15, No. 1.
[25] Rosenberg, N., 1982. *Inside the Black Box. Technology and Economics.* Cambridge University Press. Cambridge.
[26] Saint-Onge, H., 1996. Tacit Knowledge: The Key to the Strategic Alignment of Intellectual Capital. *Strategy & Leadership,* March/April.
[27] Senge, P., 1990. *The Fifth Discipline. The Art and Practice of the Learning Organization*. Doubleday, New York.
[28] Spender, J.-C., 1993. *Competitive Advantage from Tacit Knowledge? Unpacking the Concept and Its Strategic Implications.* Graduate School of Management, Rutgers University, New Brunswick.
[29] Ståhle, P., Grönroos, M., 1999. *Knowledge Management – tietopääoma yrityksen kilpailutekijänä* (Knowledge Management – Intellectual Capital as a Competition Factor). Ekonomia-sarja, WSOY, Helsinki.
[30] Teece, D., J., 1987. Profiting from technological innovation. In Teece, D. J. (Ed.): *The Competitive Challenge.* Ballinger. Cambridge.
[31] Teece, D., J., Pisano, G., Shuen, A., 1992. *Dynamic Capabilities and Strategic Management.* University of California. Berkeley.
[32] Trevino, L., K., Lengel R., H., Daft, R., L., 1987. Media Symbolism, Media Richness, and Media Choice in Organizations - Symbolic Interactionist Perspective. *Communication Research,* 14(5), 553-574.
[33] Winter, S., G., 1987. Knowledge and Competence as Strategic Assets. In Teece, D. J. (Ed.): *The Competitive Challenge.* Ballinger. Cambridge.