KNOWLEDGE CREATION AND SHARING IN PROJECT-BASED ORGANIZATIONS*

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The following paper highlights some crucial distinctions between explicit and tacit knowledge, particularly as far as knowledge creation and knowledge arising from a project planning process are concerned. The special benefits and challenges that project management brings to knowledge management and organizational learning, the nature of knowledge contents crucially influencing the nature of organizational (project management team) learning, shall also be described. These findings have implications on several areas of project management's on-going interests, such as capability maturity models, project management frameworks, supply chain management, and relationship with performance. A major part of this paper deals with an explanation of Nonaka's SECI model role in project planning and managing process.

knowledge management; project management; SECI model; project model; project lifecycle; project formalization tools

INTRODUCTION

Project management plays an important role in most companies – stretching from fields such as transportation to finance, utilities to education. Despite this, projects are often delayed and/or suffer cost overruns, others not even managing to meet their original goals. Agricultural projects are not an exception. Although agricultural projects have their own specifics they basically deal with the same problems. Most project planning failures are due to an incorrect understanding of knowledge transfer in an organization, mostly on a person-to-person basis. Improving this situation involves, besides application of more sophisticated methods, enforcement and better utilization of various types of organizational knowledge, particularly project-based. Many companies believe that projects provide an important means for gaining knowledge and organizational learning, both for general enterprise-wide issues and for managers of projects themselves. Knowledge is increasingly seen as a key yet often underestimated asset. Whilst classical Knowledge Management tends to focus on aspects of its acquisition, storing and retrieval of knowledge, knowledge creation, its dissemination and application is also vital. Organizational learning addresses much of this, looking at the way organizations learn and apply new knowledge, skills and behaviors in order to improve their performance. Good understanding of knowledge transfer processes and knowledge transformations is a key for improving project planning and managing processes in learning organization.

MATERIAL AND METHODS

Knowledge and knowledge management are somewhat elusive terms. Knowledge management (KM) has been defined as the process of systematically and actively managing and improving the quality of knowledge base in an organization; as the framework for discovering, capturing, transmitting, and reusing knowledge to gain competitive advantage (Morris, 2002).

In recent years the process of knowledge creation has begun to dominate over the more awkward split of KM. Influential writers such as Boisot has pointed out how the process of creating knowledge in an organization can illuminate the challenges of managing knowledge and generating improved organizational performance (Boisot, 1998). Dierkes et al. (2001) suggest that the process aspect of the nature of "sharing knowledge by learning" is the area where scholars still diverge most. They identify three models.

- first are those which portray learning in terms of steps or phases – with knowledge acquisition through diffusion and sense-making to action and then storage;
- second, those based on feedback loops between the organization and its environment – with a grouping particularly interested in strategic learning ('double loop' to achieve cognitive learning) (Argyris, 1992);
- more recently, a third "spiral model has emerged as a way of capturing the dynamic process of knowledge creation".

Of the latter, Nonaka's model of moving between tacit and explicit knowledge is the most developed. Boisot also recognizes this movement, in his concept from tacit to explicit knowledge and back again is core to the way knowledge is created. He proposes a four stage sequence where:

- knowledge is shared on a tacit to tacit basis
- then tacit knowledge is articulated as explicit knowledge

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- then explicit knowledge is combined with other explicit knowledge
- and explicit knowledge is internalized (embodied) as tacit knowledge.

The process is repeated, spiraling within the organization, supply chain, group, etc., as shown in the SECI spiral – Socialization, Externalization, Combination, and Internalization (Nonaka, Hirotaka, 1995). For project-based organization, for project planning and managing process respectively, tacit knowledge of project management teams plays a major role. Tacit knowledge underlies many competitive capabilities. The experience, stored as tacit knowledge, often reaches consciousness in the form of insights, intuitions, and flashes of inspiration. The capacity of mind to make sense of previous collection of experiences and to connect patterns from the past to the present and future is essential to all innovations. "The creativity necessary for innovation derives not only from obvious and visible expertise, but from invisible reservoirs of experience". Tacit knowledge, as opposite to explicit knowledge, is far less tangible and is deeply embedded into an organization's operating practices. It is often called 'organizational culture'. Tacit knowledge includes relationships, norms, values, and standard operating procedures. Managing tacit knowledge is a significant challenge in the business world – and it requires more than mere awareness of barriers. During the new idea generation – divergent thinking – phase, people create a wealth of possible solutions to a problem.

KM in practice tends to deal simultaneously with both information and knowledge. KM practices will, for example, be interested in the capture, filing and retrieval of directories of information to the enterprise – supplier information, technical and scientific information, 'who knows what' directories, etc. The distinction that is crucial here is between explicit knowledge – that which is 'readily available' – and tacit – that embedded in a person's experience and often difficult to articulate clearly (Nonaka, Hirotaka, 1995). Crucially, as Fig. 1 shows, explicit knowledge is more amenable to IT management while tacit requires contact with people. KM in practice tends to deal with both. 'Management' knowledge, as opposed to scientific or engineering based knowledge, is typically much more tacit than explicit. Scientific knowledge is more publicly verifiable than social, while engineering knowledge applies both mathematics and the 'hard' sciences (physics, chemistry, etc.) and the 'soft' sciences (such as economics, sociology and management). Project management (PM) as itself tends to both managerial and engineering sciences. Management knowledge is even more problematic: it is highly contextual and complex and difficult to render into generically valid forms. As a result there are plenty of theories about management but few laws (Griseri 2002). The multi-disciplinary, contextual, and experiential nature of management explains why many people find it more attractive to read or hear at first hand managers' tacit learning (Table 1).

Project management and various types of knowledge

Projects are recognized as important opportunities for organizational learning, adapting and self-developing. However, there is still something of a blank wall: there is little recognition of how effective project management practices could improve knowledge management and very little discussion of their importance to improve project management performance and competences. Knowledge management and organizational learning (OL) in project-based organizations confronts difficulties that are not commonly encountered by non-project organizations. Project-based organizations work on life-cycles that are often long, developmental, non-repetitive, and typically organized around teams assembled specifically for the project that are often disbanded, sometimes quite rapidly, upon the project's completion. Typically, companies come together for the first time in 'the organization' (i.e. the project): this means there is often a scramble to create the right KM/OL culture, locate knowledge 'assets', and access and internalize previous learning. Supply chain patterns and procurement practices militate against effective learning practices. These difficulties are exacerbated by problems of measuring performance in projects, and hence relating KM and OL to performance improvement. For example, definitions of success vary between participants and over time. Further, traditional definitions of project management have been largely execution driven, that is, focused around 'on time, in budget, to specification' delivery. The broader 'management of projects' perspective, on the other hand, looks at the positioning of the project in its business/social context and focuses equally on optimizing the definition of the project as well as its execution (Morris, 1997). At this level however knowledge becomes especially broad and the challenges of effective KM and OL become substantially greater. A particular difficulty is defining the project performance indicators that relate best to business performance, given there are several potential measures, often several different organizations involved with differing performance objectives, time delays, and often weak

Table 1. The role of explicit and tacit knowledge in managerial and engineering sciences

	Managerial sciences	Engineering sciences
Explicit knowledge	Use of IT systems and DSS	Use and design of quantitative tools and IT systems
Tacit knowledge	Understanding people needs, finding ways of putting people together. Sharing best practices.	Understanding meta level of explicit systems and models. Designing of metamodels. Sharing best practices.

causality. Nevertheless, there are real strengths that project management can bring to the effective project management organizations manifest, coupled with the excellent leadership, team and other organizational behavior practices that they will also exhibit. Projects thus have a vital part to play in KM (Morris, 2002).

RESULTS

Knowledge enablement using projects and PM tools

As an instrument for better understanding and explanation of the knowledge creation, enablement and sharing using PM tools will be the Nonaka knowledge enablement spiral (Nonaka, Hirotaka, 1995) and the Knowledge creation and enablement mechanisms scheme (Clark, 2004) – see Fig. 1 – where the knowledge enablement spiral relates to four circles around the "Knowledge Conversion" item. In this mechanism history and the whole evolutionary process of project oriented learning organization is demonstrated. The qualification of organization project team demonstrates surroundings of the "Knowledge" item. Organizational data and information background lies in the lower corner of this scheme. Later in this paper the role of four circles surrounding Knowledge conversion – four quadrants in Nonaka SECI model – in project oriented organization will be explained and demonstrated on project planning and managing process.

1) Socialization – from Tacit to Tacit: Sharing experiences with others (sympathized knowledge). The process that transfers tacit knowledge in one person to tacit knowledge in another person is called socialization. It is experiential, active and a "living thing," involving capturing knowledge by walking around and through direct interaction with customers and suppliers outside the organization and people inside the organization. This depends on having shared experience, and results in acquired skills and common mental models. Socialization is primarily a process between individuals.

Project Management View: Each project contains a story – from the definition of project goals and aims through pre-realization phase and formalization, current project schedule changes, till realization and evaluation. The project model is formed according to the project manager's aptitude and skills. By discussing best practices among members of a project management team, present project progress, by managing slippages, retrieving errors, and rescheduling project tasks, the teams' tacit knowledge is shared (Fig. 2).

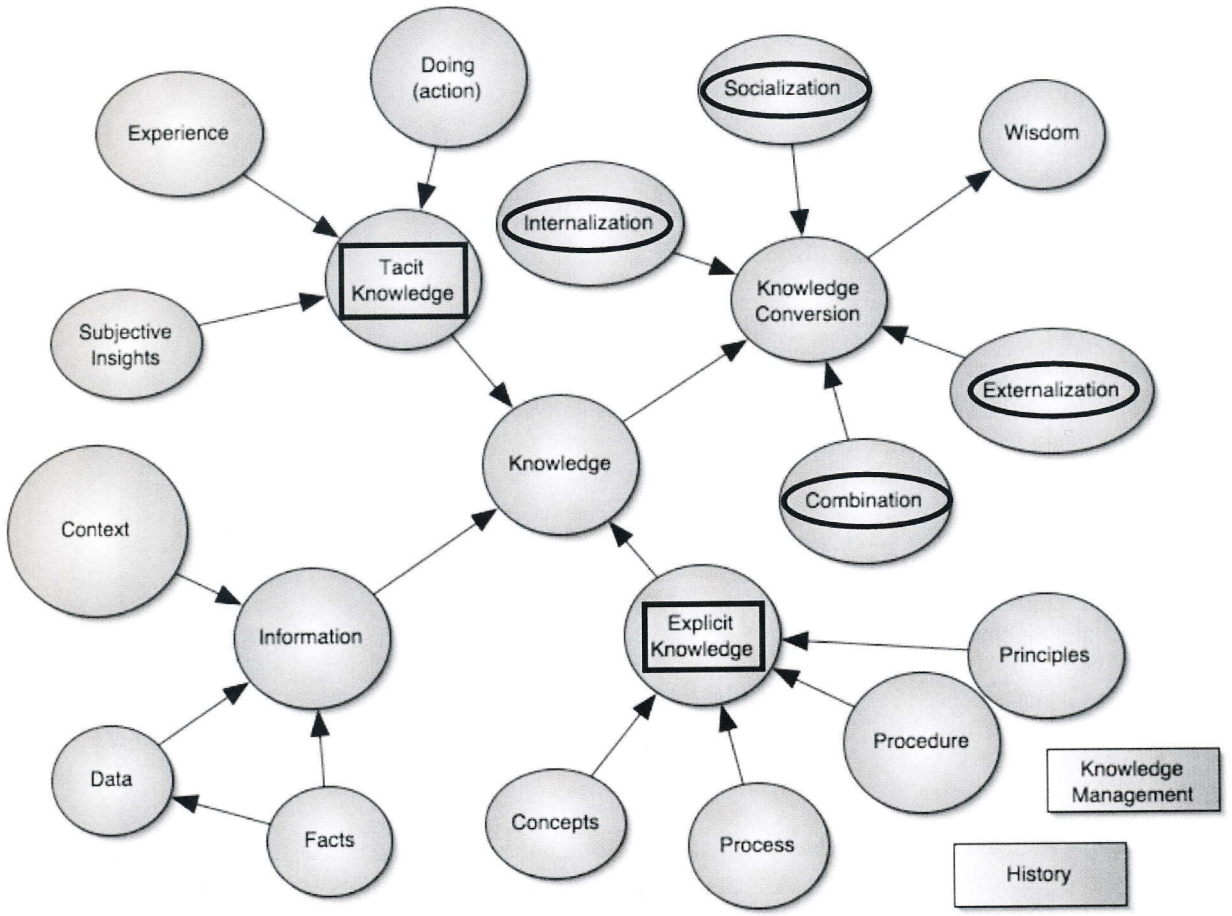

Fig. 1. Knowledge creation and enablement mechanisms – Knowledge Typology Map (Clark, 2004)

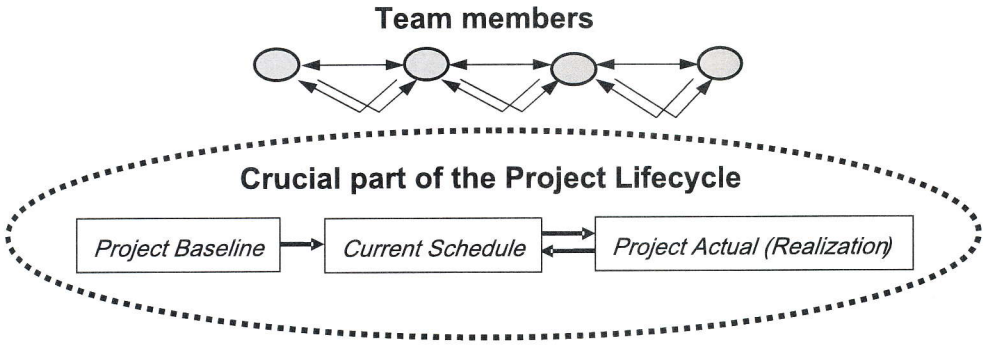

Fig. 2. Sharing tacit knowledge capturing information on project lifecycle

2) Externalization – from Tacit to Explicit: Articulate "conceptual" tacit knowledge explicitly through the use of such techniques as metaphors and models. One case is the articulation of one's own tacit knowledge – ideas or images in words, metaphors and analogies. A second case is eliciting and translating the tacit knowledge of others – customer, experts for example – into a readily understandable form, e.g., explicit knowledge. Ability to create model, model as itself includes a form of tacit knowledge.

Project Management View: In frame of project management externalization of knowledge directly deals with evolving of project mathematical and logical models. Formalization of tacit knowledge means correct use of tools to be able to intercept as much features as possible of a real project in combination with experiences and skills of project manager. Externalization of project knowledge closely depends on a target group, whether such information will be accepted by different levels of managers, mathematicians, executives etc. Mathematical modeling as an externalization tool of the project itself includes tacit knowledge which may not be intelligible for everyone! (Fig. 3).

3) Combination – from Explicit to Explicit: Manipulating explicit "systemic" knowledge through such techniques as sorting and combining. For this to occur, the knowledge elements must "fit together".

Project Management View: In the area of project management mostly technical tools should be used for knowledge externalization. Conversion among various project views should be understood as knowledge combination. Thinking about two mostly used formalization tools for projects – Network Diagram and Gantt Chart, conversion project information one to another follows all features of explicit to explicit information enablement. When linear (Gantt) diagrams of projects allow manager a good orientation in project time schedule, network diagram allows better understanding of project structure and task relationships. Other project views (various cross tables and incidence matrixes) allow information and consequently explicit knowledge about resource assignments, usage or availability (Fig. 4).

4) Internalization – from Explicit to Tacit: This is "learning by doing" (operational knowledge) and sharing mental models and technical know-how. Internalization is the process of understanding and absorbing explicit knowledge in to tacit knowledge held by the individual. Knowledge in the tacit form is actionable by the owner. Internalization is largely experiential, in order to

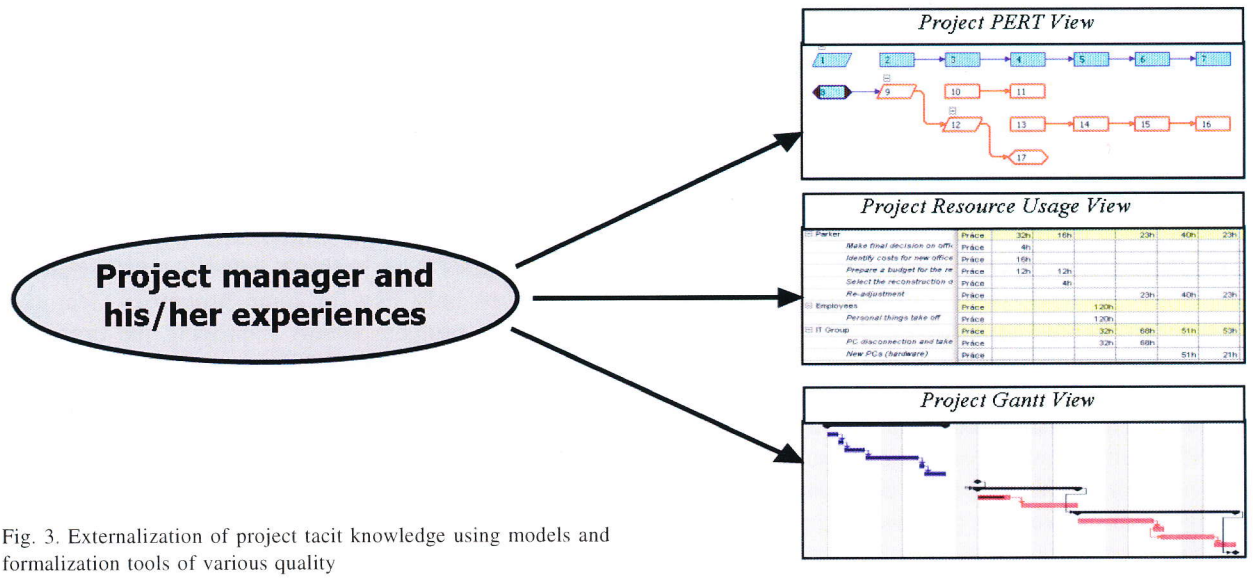

Fig. 3. Externalization of project tacit knowledge using models and formalization tools of various quality

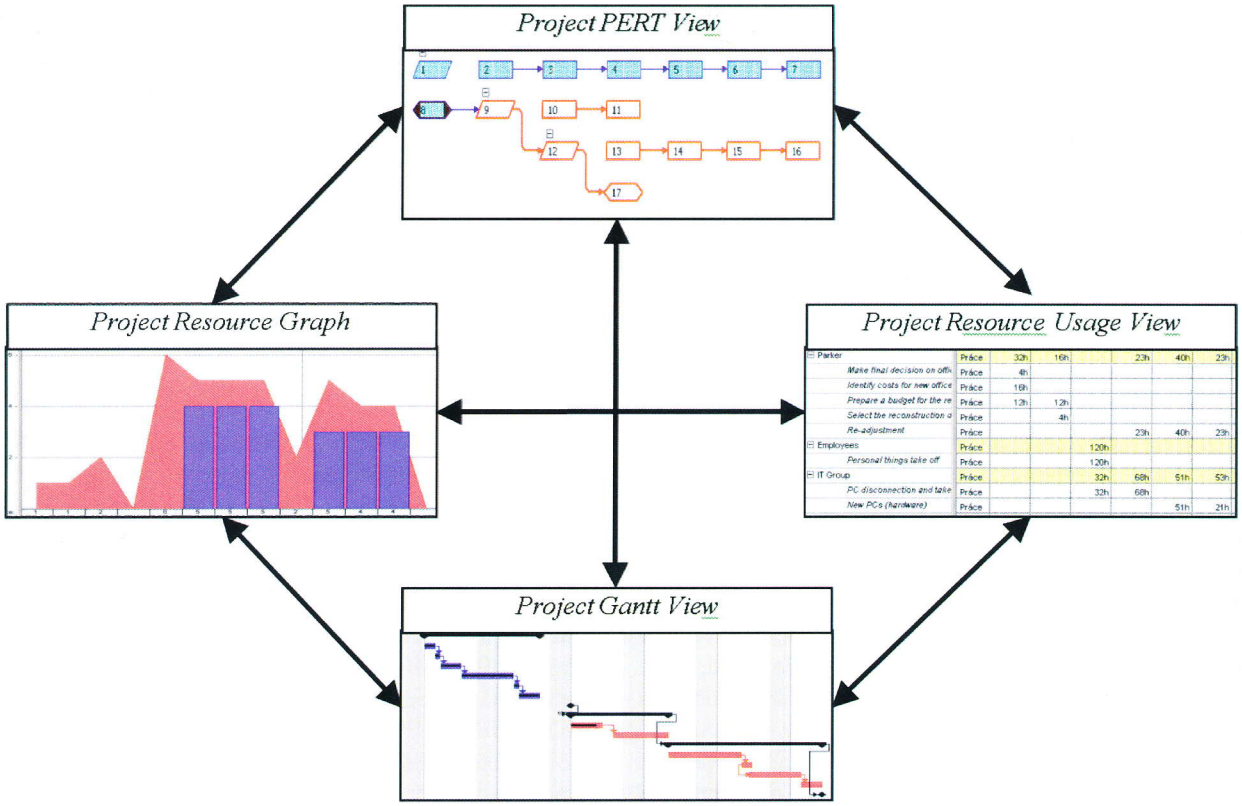

Fig. 4. Project knowledge combination

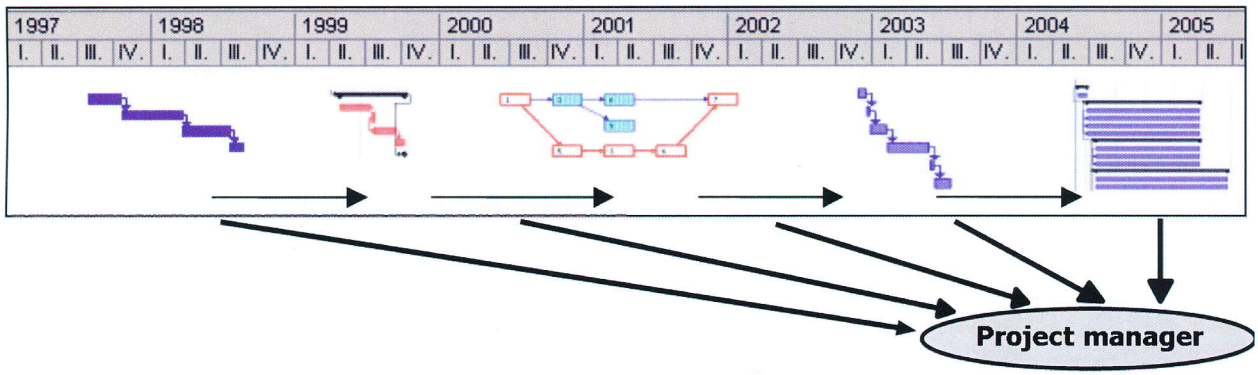

Fig. 5. Projects solved in the past affecting project manager's professional skills – internalization of project knowledge

actualize concepts and methods, either through the actual doing or through simulations. The internalization process transfers group explicit knowledge to the individual.

Project Management View: Internalization of project knowledge closely deals with the personality of project managers within the project management team and with his or her individual aptitude. In contrast to externalization, in explicit to tacit knowledge conversion time plays a very important role. The ability of project manager (PM team) to adapt past project results to improve his or her skills for further project designing is dependent on time spent on working on various kinds of projects (Fig. 5).

DISCUSSION

Confronting an organization with any new project always implies new problem solving, either new as a whole, or only new in some properties, features. Solving this problem entails improving the organizations' (or project managers' team) knowledge base quality, for better knowledge enablement in the team. Project oriented organization is always a dynamically developing one, but this development not always tends to strengthen the ability to solve various type of projects. Knowledge enablement and sharing dynamic process generates two types of organization. On one hand

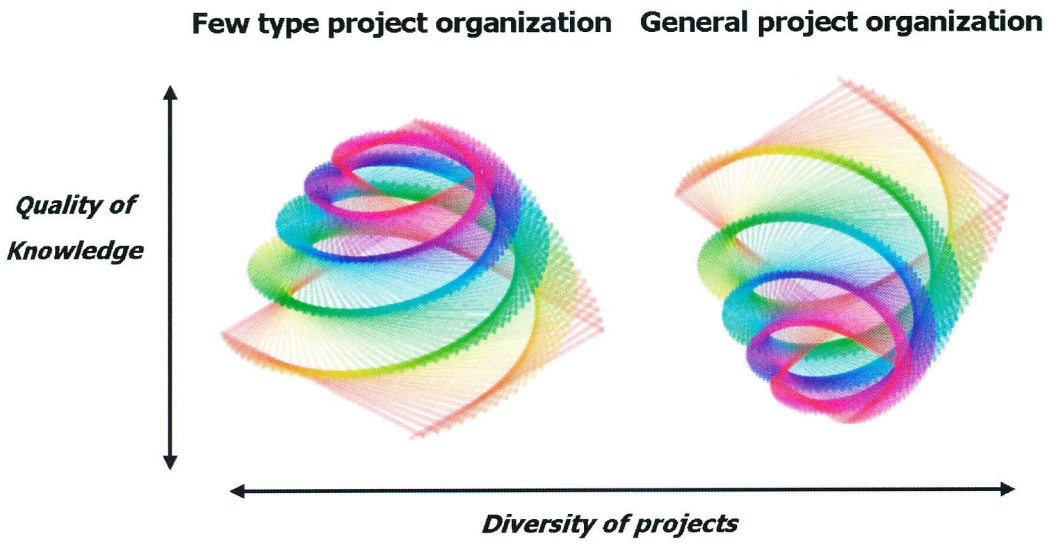

Fig. 6. Nonaka spiral inside various types of project based organizations

broadly, generally oriented, on the other hand closely specialized, mostly on only one type of project problems. The point, where the quality of knowledge branches these two types of organization, where the gap between them starts to grow, is really hard to define.

CONCLUSION

Projects emerge as particularly powerful means of effecting knowledge creation, enablement and sharing. Project management brings many skills and practices that, properly applied, will facilitate both knowledge management and the learning process of an organization. At present time projects in their life cycles are not as effective as they should be for learning about project management, because of a low level of common knowledge of project importance for knowledge transfers and sharing. Project models, including information and knowledge, need to be recognized and studied systematically in order to improve knowledge enablement in educational organizations. In many organizations project managers are closed and locked teams, with low level information and knowledge flow between them and other parts of the organization. Yet the number of practices, tools and conditions may be appropriate for different stages of knowledge creation.

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Vytváření a sdílení znalostí v projektově orientovaných organizacích.

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Článek si klade za cíl vymezit roli tvorby, sdílení, transformace a přenosu informací a znalostí v projektově orientované organizaci, tedy v organizaci, jejímž hlavním oborem činnosti jsou návrhy a realizace projektů. Projektem budeme dále rozumět „řízený proces aplikace úkolů a zdrojů s definovaným cílem v určeném časovém rámci", nebo také „souhrn vzájemně provázaných činností, které je třeba v konečném čase provést k dosažení stanoveného cíle". Postupy projektového managementu a jeho formalizační nástroje patří mezi obecně známé, především pokud jde o fáze životního cyklu projektu a o nástroje zobrazovací či ryze výpočetní. Méně známým jevem v projektovém managementu je doprovodný efekt vytváření, transformace a rozvíjení znalostí v organizaci. S každým realizovaným projektem roste jak datová a informační základna organizace, tak znalostní báze týmu projektových manažerů. V každé fázi životního cyklu projektu od „zrození myšlenky", přes směrný a aktuální plán až po realizaci cíle a dopad projektu na své okolí dochází ke kvalitativní transformaci symbolů v data, dat v informace, informací ve znalosti. Znalosti se v průběhu jediného realizovaného projektu za aktivní participace projektového týmu postupně mění z explicitních v tacitní a naopak, přičemž s každým opakováním této přeměny dochází ke zkvalitňování znalosti, ke zrození znalosti nové.

Východiskem pro vysvětlení této transformace je Nonakův model (N o n a k a , H i r o t a k a , 1995) Socializace – Externalizace – Kombinace – a Internalizace znalosti ve spirálovém vývoji v kombinaci s procesem zrodu a vývoje znalosti postupně od pochopení symbolů až po komplexitu moudrosti (B r o ž o v á , H a v l í č e k, 2005) – viz obr. 1.

Nástrojem pro podchycení explicitní znalosti projektu coby řešeného problému, resp. celého projektového portfolia organizace, mohou být různé typy síťových grafů, lineárních diagramů, histogramů, WBS diagramů a tabulek. Každý z těchto nástrojů podchycuje jinou kvalitu informace, její interpretace v kontextu kvality i kvantity řešeného problému pak znalost samu o sobě. Vlastní matematický model, stojící za touto grafickou reprezentací, už sám obsahuje znalost tacitní, neboť je výsledkem zkušeností projektového manažera s projekty předešlými v kombinaci s ostatními životními zkušenostmi, které se pak odrazí v kvalitě a vypovídací schopnosti vytvořeného modelu projektu (H o u š k a , B e r á n k o v á , 2005). Různou formou zobrazený model pak v sobě zachycuje různé části a úrovně tacitních znalostí manažera, různým způsobem pochopitelné pro cílovou skupinu, jíž je model určen. Diferencovaná kvalita výstupů formalizačních nástrojů spolu s průběhem životního cyklu projektu a ve spolupůsobení se znalostní bází týmu projektových manažerů dokonale kopíruje proces transformace znalostí podle Nonakovy spirály i její vývoj a rozvoj v čase (N o n a k a , H i r o t a k a , 1995). Analýza fází znalostní spirály a vývoje znalostí v projektově orientované organizaci ve spojení s procesem plánování a řízení projektů umožní lepší využití kvalifikovanosti týmu manažerů a pomůže efektivitě procesů v učící se organizaci.

znalostní management; projektový management; SECI model; projektový model; životní cyklus projektu; nástroje pro formalizaci projektu

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