SUPPORT FOR KNOWLEDGE AND INNOVATIONS IN SOFTWARE DEVELOPMENT
Community within Company: Inner Source Environment

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Abstract: This case study considers a software development support portal adapted from open source developer communities into a company internal, so called inner-source development environment. With theoretical insights into knowledge management (KM) models, recent advancements in KM theory building, and observations of the inner source platform we make observations as regarding the KM approach and suggestions for its further development. Both technological and human components of KM are considered. The results of this study, can be generally applicable to the knowledge creation and innovation support in software development. We believe that many software companies are following the example and building virtual environments to support the knowledge processes and innovation in their activities. The case company, Nokia, is a pioneer in KM efforts for the software organization.

1 INTRODUCTION

The capital that a software organization is exploiting in its production process is for the major part intellectual. Software development organizations are utmost knowledge intensive, and this is why investments into knowledge management (KM) e.g. by creating ecologies for innovation have a significant role in the development and renewal of the software organizations. The advancements in knowledge management research are therefore attentively followed and applied in leading software organizations. This study aims to add as an interpretive case study (Guo and Sheffield 2006) to the body of knowledge on KM for an increased understanding of the variegated dimensions of organizational activities. The focus of the study is inner source, which means facilitating a web community within an enterprise. This setting exploits the knowledge creation dynamics of a virtual community for commercial software development.

1.1 Nokia

Software development represents a significant portion of the research and development activities undertaken in our case company Nokia. Therefore, it could be seen as a software development organization. Nokia has gained recognition of its exemplary role as a front line organization to adapt KM practices (Goh 2004, see also "Entovation". `www.entovation.com/whatsnew/knowledge-economy.htm` or "The KNOW Network" `www.knowledgebusiness.com`). The company developed and deployed a framework for organizational knowledge creation and management in late 1990's (Känsälä 2000). The SECI model of knowledge creation (Nonaka 1994) was generally the framework of reference for the early adopters of KM. With further findings of the contemporaries, and company's own R&D, it was influential for the conceptualization of related issues also at Nokia.

However well known the theoretical KM concepts were, specific at Nokia was the pragmatic

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approach taken to the KM thus avoiding the problem of bringing burdening extras to the actual work processes and embedding KM into the software development processes, guiding methods and practices (see e.g. Pöyry et al. 2005). This made KM at Nokia "seaworthy". Further insights into knowledge management were brought up later, taking into account the human component of KM and stakeholder involvement to the ongoing development of the KM environment at (Meriluoto 2003). There may be several factors contributing to Nokia's excellence in knowledge management (Goh 2004) but the underlying scientific work with which the practices have been nurtured cannot be without influence.

1.2 New Challenges

The business environment is changing fast. Business models, methods and practices of the software developer companies are challenged firstly, by the open source software development that have shown the power of communities working in virtual environments and joining forces around the globe. Secondly, the ultimately short time-to-market of e.g. new e-services, with arising new requirements to client systems and device operating systems demand from the system developers a swiftly acting and reacting software organization. Further, the agile software development methods set new requirements to the software development (SWD) organization. Their aim is not only to limit the development time but also to tackle the everlasting problems of end-user involvement (Abrahamsson et al., 2003).

Nokia has been one of the first ones to realize the challenge and the potential that open source software communities present to the software business, both in interaction with the open source community (cf. www.maemo.org) and in experimenting with a similar methodology within company, creating an inner-source SWD environment (Dinkelacker et al. 2002). Since the introduction of interactive services on wide area networks, potential of the immediate involvement of the customers and business partners as a resource in both new product development and quality management has been exploited (Armstrong and Hegal 1997, Finch 1999, Hippel 2002). In the SW product creation process these stakeholders are to be included in the virtual environment supporting SWD. Network centric software product development has been discussed as an overall approach (Mazhelis, Pulkkinen & Vikman 2006), presenting, however, more challenges than solutions.

Facing all these factors a need to review the KM approach of SW development at Nokia arises, while product creation can be solved easier, even in networks (Meriluoto et al. 2004) . In this study, we are looking at a support service for software development, the Nokia iSource portal that is founded on an open source software community tool (the free version of SourceForge software). It is used as Nokia "bazaar" for a variety or projects. It was first adopted by innovative research projects but currently business projects utilize its version control tools (CVS and Subversion). This study considers the support the inner source SWD. Before discussing the tool, theoretical issues for the evaluation of the virtual environment are discussed.

2 THEORETICAL ADVANCES

Backed up with a rich base of KM literature, two models or approaches are presented in a knowledge management framework (Malhotra 2000):

- Information processing, meaning systems to support the optimized use of information and the knowledge as its interpretation in the activities of an organization.
- Sense-making allowing for flexible, exploratory and experimental use of information for creative use of it and for enabling novel solutions and innovation to emerge.

The elements considered for the two models are i) the strategies for business and technology, ii) organizational or administrative control, iii) the culture for sharing information (or constructing objective knowledge), iv) the representations used for this, v) the organizational structures and vi) managing styles (Malhotra 2004).The constraints or the enablers of these factors are in the Model 1:

i. Pre-definition of outcomes as strategy
ii. Control for consistency
iii. Information sharing based upon contracts
iv. Static and Pre-specified knowledge
v. Insular and Top-Down organization
vi. Managing for achieving compliance

Although the author presents Model 1 as leading to decreasing returns, in some settings, for periods of moderate change, this may be the reasonable model. Knowledge management systems (KMS) design emerges from this thinking. If novel products and designs are the major source for incomes, and in periods of rapid organizational change, Model 2 may be the preferable one. The elements of Model 2 are

i. "Re-everything" (re-engineer, re-design) as strategy
ii. Self-control for creativity
iii. Information sharing based upon trust
iv. Dynamic and constructed knowledge
v. Inclusive and self-organized organization
vi. Managing for achieving commitment

A goal of the case company is rapid development of services software and devices with embedded software, so Model 2 seems to be the more promising for the case and will be tested in this study. From the characteristics of the elements for Model 2, it is apparent that human factors are cogent.

In KM literature, an emphasis on people related issues seems to gain attention. Knowledge is widely seen as a concept that cannot be separated from human behavior (Davenport and Prusak 1998, Maier et al 2005, Smith and McLaughlin 2004) or is intrinsically human behavior (Alveson and Kärreman 2001). In accordance, Malhotra (2004) points that knowledge is active (presuming human action), affective (presuming human emotive behavior) and dynamic: Involving human interpretation, and an on-going re-interpretation of data or information. Any machine intelligence presupposes human pre-programming of interpretations of inputs and processing rules; interpretation of data and information can be done only by humans. This we see as the field of KM systems (KMS).

For a focus on creativity, Goh (2004) is suggesting "knowledge innovation" (KI) that is derived from knowledge and innovation management thinking (cf. Tushman and Anderson 1997) and seen as opposed to the more technology (KMS) related knowledge management principles. KI means in the view of Goh merging innovation management aspects with knowledge management practices. The KI is organized around the concepts i) innovation value systems, ii) collaborative knowledge strategy, iii) strategic knowledge networks, iv) hybrid human-technology KM solutions and v) bottom-up knowledge processes. The target is customer success as opposed to the narrower (monetary) value for customers.

The value of communities (communities of practice or of knowing, thought communities, Tuomi 2000) has been a cornerstone of KM research. Communities have the power to amplify the potential of individuals for knowledge processing and creating. Information and communication technologies enable virtual teams, communities and collaborative environments across the globe but can be used to support also co-located teams in information storage, processing and retrieval making them more powerful for knowledge work. For commercial organizations regardless the industry, the power of communities is harnessed most often for KM purposes. The European Forum of Quality Management reports March 2002: 74% of knowledge leaders rely on CoP's in a survey in 27 companies, 41% of which employ >10 000 people. The CoPs have become crucial especially to extended enterprises (Meriluoto 2003:2).

The strength of the open source software (OSS) development is organization as virtual communities around an activity. Achieving the human motivational factors inherent in self-organizing communities remains a challenge within commercial software development organizations. For a commercial setting the challenge is to sustain the good motivation.

2.1 Three Types of Organizational Processes

For the elaboration of factors significant for KM, and especially the human related factors, a profound understanding of organizational processes is a good starting point. In a meta-study on organizational processes that explores the process knowledge of multiple disciplines, the processes in an organization fall into three major categories: the work processes, the behavioral processes and the change processes (Garvin, 1998). The problematics of software engineering and its tool support can be viewed in the light of these process categories.

The work processes are the part of the activities that can be manipulated. A work environment for rich knowledge storing, retrieving and processing as well as features and platforms for communication, information sharing and exchange can be set up. A learning before and during a task (Ghalib 2004) are parts of the information processing line of knowledge management, the KM environment for work (in accordance with concepts like on-demand learning and support for knowledge work). This means the single-loop learning (Argyris and Schön 1978) for optimizing within a current paradigm (Malhotra 2000). Defined work processes, for SWD presented in methodologies and SE models, are used as reference models.

However, the behavioral processes take place according to the motivations, incentives, rewards and disincentives for humans in a social (work) setting. The social aspect of work provides diverse motivational factors directing human behavior both as individuals and as groups. The managerial actions here foster and facilitate rich access to knowledge and allow for learning after a task (Ghalib 2004) meaning a reflection on one's own actions and incorporating the new knowledge. This means looking for renewal of practices and creation of better solutions. A possibility of double loop learning (Argyris and Schön 1978) or making sense in an undefined situation (Malhotra 2000) can be seen possible if the behavioral processes head towards gaining deeper knowledge and creating understanding of the unknown.

In any case, organizational change processes are taking place: no organization remains the same over time. Garvin mentions innovation as one of the change processes. Innovation is one of the goals in the KM efforts. To induce a desired change, the setting up of the work environment and definition of the work processes, the roles and resources for them are the first managerial task. As important is however, to set up a motivational environment with reward systems and incentives that direct the actions of individuals towards enrichment and renewal of both individual and the organizational knowledge.

Organization, management and motivation theories provide a rich prism through which to examine the behavioral and change processes. The scope of the study does not allow for elaboration of all these, but we would like to point to the communities mentioned above, and the motivational issues that guide the behavioral processes further leading to change processes.

In OSS communities, the voluntary participation relies on the assumption that for many developers the desire to build their reputation and maintain it provides a strong motivation for a long-term engagement in the development. Further, the sense of belonging: membership in a community; respect by peers, possibility for promotion in the community and in general achievement and contribution to a whole are motivational factors resulting to productivity in an OSS community. Affiliation, achievement and power have been established as the main motivational components in work situations (McClelland 1961). Further, challenges, task autonomy, intrinsic interests and creative opportunities (Herzberg 2003) are driving factors in an OSS community type work environment as well as expert organization principles (Drucker 2006). Similar suggestions are made by Bahrami and Evans (2005) based on Silicon Valley studies for knowledge work management. Perceived fairness (Kim and Mauborgne 1997) is further a strong motive for behavior. Studies on individual and organizational motivation factors are summarized in (Rossi and Bonaccorsi, 2005).

Inner source idea is driven by the attractive results in open-source communities: faster releases (publish early and often), making the process transparent for developers and users / customers, and utilizing a (large) community to detect faults quickly. Increased quality and quick promotion of novel product ideas are believed to be due to the involvement and collaborative efforts of the developers and the reuse of their knowledge (Krogh et al. 2005). It is readily admitted that not all practices are straightforwardly implemented in the context of enterprises. For example, OS licensing, "coordination afterwards" principle, or distribution of control are challenging enterprises.

The open-source principles adopted in inner source include making the source code freely available for other developers to view, comment, use, and create new versions, though within the boundaries of the corporation and possibly business partners. From a practical perspective, this implies that several problems faced by individual developers need to be addressed, such as exchanging the information about the ongoing work within the community (i.e. acquainting with the work of others and advertising one's own), and identifying, locating and accessing the available software assets like architecture constructs, design components, or code. Services like web portals provide support for these activities of software engineers.

2.2 Systems Supporting Communities

Variegated tools to support knowledge management activities have been developed for the software development environment. Despite the concept of knowledge management system (KMS, Maier 2004) no single system can meet all the needs for KM support in any organization (Maier et al. 2005, Malhotra 2004). The two models (Malhotra 2000 and 2004) and the two approaches (Goh 2004) suggest that for creative work and support of innovation, the tools are only a partial answer.

However, especially in distributed development environments, and also for enhancing the knowledge work in co-located SWD, the virtual environments created as information and communication platforms are significant and amplify the human and organisational memory, communication and collaboration. To understand what, where and how to support, we look at the knowledge life cycle which gives a possibility to follow the evolving information and knowledge inputs.

2.3 Knowledge Life Cycle Models

Looking at the knowledge in the activities of organizations could give some insights for considering how to organize the software development work. To our view, the Model 1, or information processing guides the concrete organization of work and the defining of work processes, their phases, task deliverables etc. The organizational culture and climate, the unofficial organization (a network of social relationships and hidden power relations, highly influenced by personal characteristics of members) live in the behavioral processes of all participants. These cannot be dictated but influenced by managerial actions. The Model 2 sense making (Malhotra 2000 and 2004) or knowledge innovation (Goh 2004) are needed to take this into account.

The knowledge life cycle process models focus on the knowledge itself, not the individuals and groups of people what the SECI model does

Table 1: Knowledge life cycle models: 8 phases.

LC Phase	Maier et al. (2005)	(Ghalib 2004)
1. Creation and identification	Create, identify	Identification of knowledge
2. Encoding and externalization	Formalize, organize	Capture of the newly created knowledge + analysis
3. Make accessible	Share, distribute	
4. Validation		Validation
5. Evolution	Refine	Distillation
6. Individual use	Apply	Embedding into business processes
7. Institutio-nalization; use organization-wide		Application to business activities
8. Feedback -> return to phase 1	Feedback	

The SECI model has found use in the presentation of practical work in managing knowledge (Känsälä 2000, Meriluoto 2003). Some new aspects might be won with the knowledge life cycle models, keeping in mind the significance of the two KM models. For the analysis of the iSource service, we take models of knowledge life cycle by Maier et al. (2005) and Ghalib (2004). By combining the two life-cycle models, a total of eight distinct phases can be distinguished (See Table 1).

These phases are embedded in the organizational processes. To our view, both work and behavioral processes are needed to carry on the evolving of knowledge throughout these phases. Knowledge has the property of increasing in use, so fostering knowledge creation and enrichment could take into account these phases, and provide support and possibilities for diffusion and amplification of it.

3 CASE ISOURCE

For initial results of the inner source experiment, we conducted a case study (Yin 1994) at a Nokia unit providing and developing internal services for business units. Participatory observation was used for the collecting of evidence. This section presents the gathered experiences with Inner Source portal called iSource, and more generally with the idea of adopting practices of the open source communities within a corporation (Dinkelacker et al. 2002, Theunissen et al. 2002).

A free version of SourceForge (sourceforge.net) was customized and introduced to test and demonstrate the inner source concept. iSource was introduced as a portal, to provide the availability and openness for sharing software assets between different business units. Similarly to its ancestor SourceForge, iSource provides a set of tools for collaborative software development. These tools address the practical problems of exchanging the information about the ongoing work within the community and locating or accessing the available assets. iSource portal is integrated to local user and group management infrastructure and it also allows company staff to access the portal over an extranet.

The introduction of iSource has been undertaken in three phases so far.

- The trial phase (2001-2002). iSource was piloted with few projects that provided feedback for the portal customization. No global service is built yet, but a special support group took the server hosting.
- Adoption among research projects (2002-2005). Active deployment into research projects raised the interest and management decisions to use iSource. For example, projects that conducted following Mobile Internet Technical Architecture (Nokia 2002) started to use iSource. The amount of users when reaching the limits of the research organization. A global service is built, and a service level agreement for iSource was made.

- Adoption among business projects (2005-2006). Business interest is arising due to the investments into security and SCM services. There was a huge increase in the number of users and business projects. At present, user base of iSource amounts for few thousands of "members", i.e. employees of either Nokia or collaborating companies, 70% of them from business groups.

iSource aims to give means to tackle the common challenges of large companies: efficient reuse and cost-effective re-cultivation of software. However, the most advances, e.g. personal efficiency, utilization of agile models and available experiences of "de facto" tools, are related to the SCM tools: CVS and Subversion.

4 ANALYSIS

In this subsection, we analyse the iSource service and the tools provided by the service portal from the two theoretical starting points presented above: i) Knowledge life cycles, and ii) the human aspect of KM, captured in organizational processes and the management of them. Taking the more technical analysis first, features of iSource taken from the specification documents are compared with the phases of the knowledge lifecycle to consider the support of the knowledge processes.

In Table 2, we map the features to the phases of the knowledge lifecycle model introduced above. The mapping produced is a many-to-many mapping, i.e. each phase of the lifecycle may be supported by more than one feature of iSource, and a feature of iSource may provide support for several phases of the lifecycle.

1. Identification of knowledge. In this phase, the iSource's service helps to browse or search the available information (or encoded knowledge) on a specific topic. Creation of knowledge involves combination of existing pieces of information or knowledge with human intelligence. The search facilities of iSource offer the possibility to locate relevant projects based on keywords, browsing request information through mail-lists and forums. Besides, new releases of projects, and code snippets are available for browsing.

2. Encoding and externalization. The support in this phase mainly covers the activities related to project documentation: i) trove categorization is helpful in categorizing a newly created project so that it would be easy for others to locate it; ii) project templates provide a framework guiding project teams in externalizing and encoding the knowledge acquainted during the project work; iii) CVS facilitates concurrent development and enables the tracking of the historical development of the encoded knowledge. Besides, there are memory helps like bookmarks.

Table 2: KLC support in iSource environment.

LC Phase	Provisions in iSource
Creation and identification	Search facilities, Asking/browsing mail-lists, forums, Browsing Software Map, or New releases, Browsing code snippets
Encoding and externalization	Project templates, Trove (project) categorization, CVS, Bookmarks
Make accessible	News, Mailing lists, Forums and discussions, Code snippets, Project documentation
Validation	(Visibility of element usage), Discussions and other distribution of experienced quality
Evolution	News, Mailing lists, Forums and discussion forums, Code snippets, Project documentation
Individual use	Search facilities, Asking/browsing mail-lists, forums, Browsing Software Map, or New releases, Browsing code snippets Bookmarks
Institutionalization (Use organization wide)	Project templates
Feedback -> return to phase	Getting user statistics, Peer ratings, Surveys (per project), Quick surveys (per user)

3. Making accessible (sharing, distributing). iSource service as a whole can be seen as a tool for knowledge sharing and distribution. Indeed, a significant portion of its features represents communication and collaboration that can be employed for exchanging the knowledge among the members of iSource community. These tools include news, mailing lists, and (discussion) forums.

Besides, the coders are provided with the possibility to share potentially useful code snippets. Project documentation, while not usually deemed as collaboration tool, in fact provides a valuable element of knowledge sharing.

4. Knowledge validation. No elements of iSource appear to be directly supporting this validation, if e.g. frequency of the use of a design or other SW element is not seen as its (informal) validation. User contributions in discussions etc. naturally enable sharing of experience or evaluation of designs.

5. Evolution (distillation, refinement). iSource supports knowledge evolution by providing communication facilities: developers can distil and refine their knowledge as a result of communicating with others and by browsing the available information sources (encoded knowledge). The same facilities as listed in phase 3 above, are useful in this phase, too. The CVS may make some of the evolution transparent.

6. Application on individual basis into single processes. To an extent, also individual use of knowledge is supported in the searching and browsing facilities. However, individuals on their own rather use other tools like software development kits.

7. Institutionalization. (Broad application and incorporation into organizational processes) The project templates may be a step towards institutionalizing the knowledge embedded in them.

8. Feedback (Giving input to phase 1). The user of iSource may (voluntarily) participate in peer ratings, whereby the user can rate others and be rated by the others. This facility may be useful in assessing the "quality" (correctness, appropriateness, timeliness, etc.) of the knowledge that the user shares with the members of the iSource community. This kind of feedback, if not edited, could have unintended side effects.

Besides, for the entire iSource service, user statistics can be used to assess the usefulness of the service as a whole. These features have, however, not found real use in our case yet. In a company there is a threshold in using the service this way.

As could be seen in Table 2, the features of iSource encompass documentation templates, reuse support tools, tools for communication and collaboration in content creation, documentation and tracking tools, feedback provision tools and tools supporting reputation building, among other features. Many of these features support simultaneously several phases of the knowledge lifecycle. If no support is provided in the portal, to an extent, this is due to the availability of other tools outside of iSource (such as modelling tools, software development kits, emulators, etc.) to support the activities in these phases.

Features automating support for knowledge processing might be a possibility to add new features (agent technology). Further extensions can be envisioned for each of these categories, e.g.:

- Documentation support – semi-automatic extraction of relevant pieces of text from inter-personal communication, e.g. about decision justification;
- Reuse support – extension of code snippet library to include other reusable assets, e.g. reusable architectural elements, use cases, test cases, etc.; tools for recognition of patterns/idioms in code snippets, (agent technology);
- Communication tools – instant messaging or chat communication, audio-communication (VoIP), etc. for online collaboration;
- Collaboration in content creation – wiki-like tool for evolving content collaboratively;
- Feedback – surveys extension to include also feedback by the customers or end-users, etc.
- Other software development tools (c.f. Eclipse plug-ins)

The integration of these tools depends on the development of open source portals (e.g. GForge), and local iSource needs and priorities. However, the long term goal of iSource is to separate "own customization" with interfaces to a commodity portal software and thus lower the development and maintenance costs.

5 DISCUSSION

The adoption rate of the (voluntary) adoption of an inner source tool shows that the inner source idea does have support. An open source community portal in intra-organizational, commercial software development provides a platform for knowledge processes. Direct conclusions as regards to the profitability of iSource cannot be made at this point. However, it is supporting rather the Model 2, or sense-making knowledge management, relying on the behavioral processes of both individuals and groups of people. This setting has an indirect impact to the productivity, so the promise is a long term improvement by creating a fertile environment for knowledge sharing, elaboration and innovation.

Considering iSource against the Model 2 KM, sense-making, or the similar knowledge innovation

(KI) following points can be made: As such, the dynamics of an open source software development community cannot be transferred into a company. An OSS type portal provides support for the knowledge work at several phases of the knowledge life cycle, but does not suffice to induce a change process towards a novel organizational culture.

However, copying the concept of a virtual environment and providing support for a community implements some elements (See section 2) of KM Model 2 that help to support the transformation of the software development organization into a more knowledge management and innovation intensive one.

“Support for ‘re-everything” (i) would mean that the defined work processes in the software development are revised as to ensure that e.g. the prescribed order of work is not blocking the behavioral processes leading to knowledge creation, accumulation and a desired transfer of knowledge. This is to the most part an issue of process definition and process improvement, which can be reflected in the support. The iSource environment gives possibility to variations and does not as such fix any process models or provide any automated work processes. Some of the tool features could be harnessed to process improvement measuring if seen profitable. Iterative work is supported by e.g. CVS, and the retention facilities in general. A related issue is the “Self-Control for creativity” (ii), which can be supported by the tool by providing e.g. individual performance transparency (contributions as reusable assets, troves etc.) giving fairness to rewards.

The third element, information sharing culture based on trust (iii) can be enhanced through the transparency possible in a service like iSource. If the tool manages to create a transparent way to share knowledge it might succeed in enhancing the contributions to the whole community through individual and organizational learning. This also relates back to the previous element, self-control.

The transparency of contributions might be able to enhance the exchange and collaboration instead of striving for immediate rewards for individuals and keeping the information for oneself. However, reward structures play a role here. Communities and OSS communities in special have shown that immaterial rewards as motivational factors can out-rule material rewards. The existing other (material) reward systems in a company may, however nullify the enhancing effect the community environment might have to performance.

The next element, knowledge representations being “Dynamic and Constructed” (iv) is also related to interpersonal exchange. Knowledge cannot be fully captured but resides in the behavioral processes. However, a flexible support environment facilitates also dynamic representations. In iSource, the file formats are not pre-defined. The organization structure is not created by the tool. Representations may even emerge in the tool use.

Model 2 suggests “Inclusive and Self-Organized” organization structures (v). The support environment provides a platform that does not exclude moving towards inclusion and self-organizing teams, but this will require managerial decisions and guidance. As to the “Achieving Commitment” (vi) as the mode of management, it has to be stated that this cannot be solved with a tool but like with other elements, a supporting environment can be an enabling factor if the management is to be moved towards more self-directed actions and autonomy of company members. Finally, the work could be organised on the systems “ecology”.

Maybe the most sensitive issue in this is fairness. A virtual environment can provide the transparency needed towards self-directed, self-organized and committed motivation and work, which enhances the creation of knowledge and the amplification of it in collaborative settings. For knowledge processes, the immaterial environment like culture and managerial attitudes are influential. iSource seems promising platform in the developments in this area.

To the KMS and knowledge engineering point of view, as the pre-analysis against knowledge life-cycle models showed, there might be room for some more support by automated functionalities.

6 CONCLUSIONS

With initial experiences of the use of iSource, an inner-source software development (SWD) portal service in use at Nokia and some recent insights in knowledge management (KM) theory building we make suggestions to an improved SWD organization knowledge management approach. We reflect the iSource experiences on two KM models, and for the case consider the so-called Model 2, supported by a knowledge innovation (KI) concept. An understanding of organizational processes helps in understanding these models. Work processes (SW process and sub-processes) can be supported more directly by tool features and Model 1 KM ideas. The Model 2 KM supports the human component, emphasizing the behavioral processes in KM. For the behavioral processes of learning and knowledge renewal to innovations, the support is more indirect and subtle and needs also other managerial actions besides providing supporting tools.

The iSource portal benefits company as a "bazaar" supporting individual projects globally Nokia wide, although Inner Source practices are weakly supported. Even though the implementation of Inner Source practices would not provide productivity and performance leaps, they most likely are step into the right direction. Our considerations are that positive developments are likely to take place if some managerial concerns influencing the behavioral processes would abide the service portal implementation. These are mostly related to reward structures, taking into account both material (money) and immaterial rewards (like recognition, support, achievement etc.). Perceived fairness can be achieved by a virtual environment providing transparency to the community and the members and the contributions and resource investments.

Knowledge is created, enriched, cumulated and shared in both personal and interpersonal behavioral processes. A support environment can be beneficial for these processes: it can provide access to rich knowledge, capabilities to search, retrieve, process information for efficient work and novel combinations. However, the supporting systems can only provide a "scaffold" for the processes. Numerous factors in organizational culture, climate and managerial actions influence and direct these processes. Individual factors like intrinsic motivations add to the decisions made by an individual. However, behavior in an organisation is mostly social.

Another issue from the KM literature focusing on KMS, the knowledge life cycle, is giving background for an analysis of the functionalities of the tool as a KMS. This analysis also confirms the benefits iSource can bring to the SWD organization. It also points to further possibilities to automate the processing of externalized knowledge in digitalized retention facilities.

As has been pointed out (Behlendorf 2005, Mazhelis et al. 2006), project is a predominant concept in the software business, in organizing work, resources use, assets creation, reward systems, motivation, leadership, and commitment. Project is also the basic concept in the SourceForge and iSource environment. The software community as a whole faces now a need to reconsider the project paradigm, to be able to make progress with KM issues and tool support. As a legacy from the open source community, "project" is the major concept around which the iSource tool is ontologically organized.

Due to all the positive organizational and motivational factors the project paradigm is providing for organizing software development work, it is not feasible to suggest abandoning it. Instead, it is possible to find ways to go around the perceived problems of lacking continuity by supporting the knowledge processes from project to project. The current efforts in SWD processes expressed as software engineering methodologies (agile, XP) seem to be heading to the same direction pointed out in this study, emphasizing human involvement both from user and developer sides.

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