Measuring Knowledge Management Effectiveness in Communities of Practice

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Abstract

This paper outlines an approach to determine key performance indicators and metrics for knowledge management (KM) in communities of practice. The approach is based on analysis of the KM literature on (i) types of knowledge, (ii) processes of knowledge development and social learning, and (iii) metrics for KM, such as from the Intellectual Capital Method. To embed communities of practice and KM processes in an organizational context, we introduce our Knowledge Governance Framework, which combines knowledge resources, KM, and organizational objectives. Our first hypothesis is that successful KM in organizations requires the linking of knowledge resources to organizational objectives. Our second hypothesis is that a precondition for successful KM is that explicit, quantitative indicators are used. We tested the framework in a small organization in the financial industry. According to our first case experience, the model can be applied in a business setting and our first hypothesis is supported: successful KM links knowledge resources to company objectives . Our second hypothesis is not supported: KM in the case is not based on explicit and quantitative indicators.

1. Introduction

Communities of practice (CoP) are playing an increasingly important role in modern, knowledge-intensive organizations [1, 2, 3]. Gongla and Rizutto [2] observed over 60 communities and define CoP as 'knowledge networks, referred to as institutionalized, informal networks of professionals managing domains of knowledge'. CoP foster knowledge development and creative interactions amongst highly specialized experts and help to channel their efforts to where they are most needed [3, 4]. In this way, CoP are a key element in the learning organization. Being at the core of these companies, and knowledge being one of their key assets, a structured process of knowledge management (KM) is essential to assure the efficacy of CoPs [5]. In order to ensure that knowledge handling in a particular community is indeed effective and efficient, the performance of its KM processes has to be measured. To properly measure what is needed, *key performance indicators* can help to assess and guide the evolution of KM practices. Once a proper set of indicators has been selected, best practices and benchmarks can be collected and systematically used to improve community operations and KM.

Although a large body of literature exists on KM in general [6, 7, 8], so far not much specific theory has been formed about KM in communities of practice, let alone on the role that performance indicators play in them. On the other hand, in industry, some successful cases exist (e.g., Shell [9], IBM [2]). Still, many other organizations have failed in their efforts. Because of the lack of theory, it is not clear yet what is specific to the company, and which can be generalized and applied more universally.

In this paper we select and combine KM theory, and focus on key performance indicators in KM in organizational communities of practice. More specifically, we focus on how to define, measure, and use performance indicators for KM. Such a theoretical lens should then be used to examine successful case studies, resulting in useful and practical guidelines for KM procedures.

This paper outlines an approach to the definition, measurement and use of key performance indicators for KM in communities of practice. The approach is based on existing typologies of *knowledge* [10, 11], processes of *knowledge development* and social learning [12, 13, 14], and *metrics* for KM, like from the Intellectual Capital Method [15]. We have applied the approach in a small knowledge intensive organization (a community of practice) in a knowledge intensive industry (financial services) and conclude with a Knowledge Governance Framework to define the organizational context of the KM processes, to be tested in further case based research.

2. Measuring KM in communities of practice

In this paper, we first construct a theoretical lens with which to address the question of what role key

performance indicators play in knowledge development and KM in communities of practice.

Starting point is the community of practice. An extensive literature exists on the structure, operations, and evaluation of communities of practice [e.g., 2, 3]. However, these communities are often examined in general terms of being productive, sociable, and so on, but not from a perspective of KM in an organizational context. Such a view is necessary if KM structures, processes, and guidelines are to be recognizable and successfully implemented by management and members of organizational communities of practices. In other words, it is not sufficient to talk about abstract KM procedures, and social learning processes: these constructs need to be embedded in clear goal, task, and organizational structures. Communities can be viewed as a set of relationships where people interact socially for mutual benefit [16]. The key seems to be strong and lasting interactions that bind community members in some form of common space. In the case of a community of practice of knowledge workers, this common space is defined by the organizational context in which they operate. The question is: how to go about this? What approach can be developed that is sufficiently generic to be universally applicable across communities in various organizations, while giving enough guidance to be practical and useful for community participants, not only theoretical analysts?

To address this question, it is necessary (1) to select and combine sound and complete theory to construct an approach that allows us to clearly support KM in communities of practice and (2) to test if this approach is feasible by applying it in a real-world setting. We addressed item one by analyzing what is needed in the definition, measurement, and use of key performance indicators, and select theories that have proved themselves in practice on these issues. The second point was handled by doing an extensive case study in an organization centered on its communities of practice.

2.1. Assumptions Used in Theory Selection

The following assumptions guided us when looking for relevant theory:

(i) Knowledge resources include both *data* that is stored in databases or on web pages, and *tacit knowledge* possessed by the community members. Not all knowledge can, nor should, be made explicit, as many applications require human interpretation and subtle background knowledge.

(ii) The reason why communities of practice are so important to organizations is that they are engines of *knowledge creation*. For example, they are used to produce innovations, give technical advice on unique problems, are used as general think tanks, and so on.

(iii) This knowledge creation process is *continuous* and *expanding*: as the community matures, it accumulates and applies knowledge, resulting in an internal learning process.

(iv) KM processes do not take place in a void, but in an *organizational context*. For these processes to be effective, clear links must be made between these processes, the knowledge resources that they use and produce, and the organizational goals and workflows.

(v) Measurements of KM effectiveness in such an organizational context should ensure that appropriate *knowledge aspects* are measured. Many aspects can be measured, but not all are relevant or feasible. Apart from the SECI-processes, these aspects should include the *products* that are transformed in these processes.

(vi) Indicators are measurable operationalizations of aspects. The selected aspects should thus be measured with the right indicators that are both effective in terms of contributing to the KM goals, and efficient in terms of easy to conduct and in terms that are understood by the organizational members.

(vii) As KM continuously evolves in a community of practice, it is essential that anomalies can be detected and interventions can be done to refocus KM practices. *Diagnostic processes* must be available to detect problems and prescribe solutions so that healthy KM can be ensured.

We note that steps six and seven reflect a rather technical and rational perspective on management [17, 18, 19]. Successful KM, however, might exist without the presence of clear and quantifiable indicators. So we might find that successful KM uses 'aspects' without 'quantifiable indicators'. An example of an approach implementing similar assumptions is provided by Gongla and Rizutto [2], who list a series of KM characteristics, including vision, leadership, as well as a value system, incentives and measurements. Our aim, however, is not to be prescriptive, but to provide a simple and generic analytical lens for charting actual KM measurement practices.

We address the seven assumptions as follows:

(1-3) Knowledge resources, knowledge creation, and knowledge development: Starting point is the well-known *SECI* (Socialization – Externalization – Combination - Internalization) *model* of cyclical knowledge creation of Nonaka et al. [10, 13]. They adopt an epistemological dimension in their model, distinguishing between tacit and explicit knowledge that are continuously converted in a social learning process. *Tacit knowledge* is personal and context-dependent*, explicit knowledge* can be expressed in formal and systematic language and shared in the form of data.

The interplay between these two types of knowledge leads to processes of knowledge conversion, expansion, and innovation (Figure 1). Knowledge can be individually owned, or shared. This extra dimension complicates knowledge creation processes, as differences in individual and group perspectives easily emerge when multiple human actors are involved in knowledge (ex-)change. Some interpretations of the same knowledge entity may differ, such as the personal evaluation of how well a report is written. Other interpretations must converge,

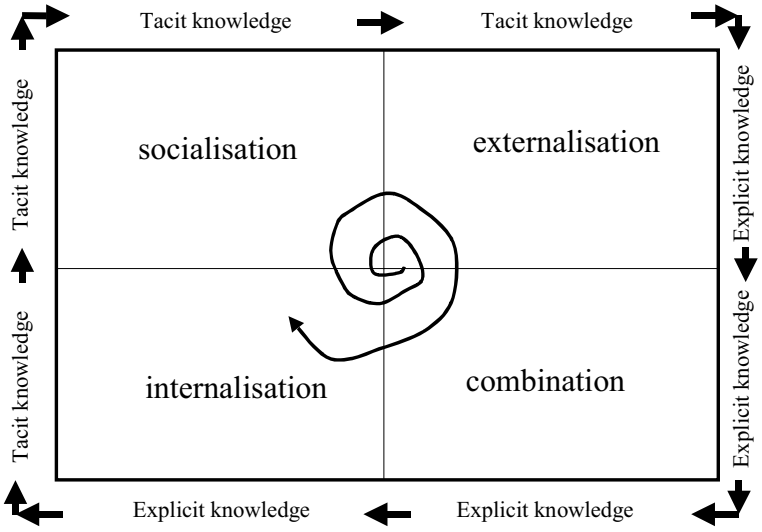

Figure 1. Types of knowledge and the knowledge creating process [10, 13]

however, such as ensuring that a joint view is developed about the course of action an organization is to take.

Knowledge is created in a continuous cycle (the spiral in figure 1) of socialization, externalization, combination, and internalization, in which knowledge is produced. *Socialization* is the process of creating new tacit knowledge out of existing tacit knowledge through shared experiences, for example in informal social meetings. Socialization leads to *sympathized knowledge*. *Externalization* is the process of articulating tacit knowledge into explicit knowledge, for example concept creation in new product development. Externalization leads to *conceptual knowledge*. *Combination* converts explicit knowledge into more complex and systematic sets of explicit knowledge, called *systemic knowledge*. This is where databases and computer-supported analysis comes in. *Internalization*, finally, is the process of turning explicit knowledge into tacit knowledge, for example by training. This type of knowledge is called *operational knowledge*.

Knowledge creation does not take place by itself. To ensure that the SECI process can take place, Nonaka et al [13] and Senge [12] have defined certain necessary conditions in the form of guidelines for effective knowledge creation. Nonaka and Takeuchi [10] have come up with a set of seven guidelines for effective knowledge creation. To ensure that the necessary conditions for successful knowledge creation have been satisfied, the implementation of each guideline needs to be critically assessed in the organization being examined. Space is lacking here to address these guidelines in detail, but they contains such principles as 'develop a knowledge crew', 'adopt middle-up-down management', and 'switch to a hypertext-organization'. In field research, we have found that these principles are useful to make a quickscan of the readiness of the organization for sophisticated KM practices [20].

(4) KM: The organizational context that ties KM processes to the organization in which they operate, is still undeveloped in the literature. A common definition of KM is "The collection of processes that govern the creation, dissemination and leveraging of knowledge to fulfill organizational objectives" [21]. KM is a framework within which the organization views all its processes as knowledge processes. Davenport and Prusak [6] define KM as: 'to identify, manage, and value items that the organization knows or could know: skills and experience of people, archives, documents, relations with clients, suppliers and other persons and materials, often contained in electronic databases. Davenport and Prusak [6, page ix] state that for most knowledge-managing companies today, the challenge that lies ahead is to integrate KM with the familiar aspects of business: strategy, process, culture, behavior.

How exactly management processes (4) and knowledge resources (1-3) tie to strategic, tactical, and operational business objectives, workflows is often left implicit or not addressed at all. To specify these relationships, we have developed our own *Knowledge Governance Framework* (figure 2), which also includes the main knowledge aspects that can be measured for effective KM. Assumptions 5 to 7 relate to measurement of knowledge, in such way that KM can be effective, or related to business objectives.

(5) Aspects to measure: The aspects to measure are first of all the SECI-processes of socialization, externalization, combination, and internalization. However, sometimes, these processes cannot be measured

directly, or need to be corroborated by the knowledge resources that they produce and consume. Four important methods that can be used to measure intangible resources are the Human Resources Accounting method, the Economic Value Added method, the Balanced Scorecard method, and the Intellectual Capital method [22]. For measuring knowledge resources, the *Intellectual Capital method* is best suited, as it provides both a theoretically complete and practical approach for measuring intangible resources.

(6) Indicators; As little research is known so far on what effective and efficient indicators in this context are, the approach in this initial stage was exploratory [23]. As participatory observers, we let community members themselves define which *indicators* they thought to be effective and efficient [20]. In future research these indicators can be compared with those found in other case studies, and improved using meta-criteria for indicator quality, e.g. [24].

(7) Diagnosis and feedback: After indicator values have been measured, diagnostic processes can be conducted to compare actual values with benchmark or target values. Two forms of diagnostics are conducted: first, simple indicator value assessments, using the own insights of the community about both actual and desired values. However, these isolated value comparisons are not sufficient. To conceptualize systemic breakdowns in the knowledge creation process, we have adopted Senge's [12] *systems view on the learning organization*. Senge sees the organization as consisting of circles of causality, which amplify or stabilize processes of, in this case, KM and organizational learning. Using recurrent patterns called archetypes, *learning disabilities* can be detected and remedies prescribed.

Summarizing, steps 1 to 4 (knowledge resources, knowledge creation processes, knowledge development, and KM in the organizational context) form the KM part of our approach. Steps 5-7 (measuring knowledge) form the measurement part. In section 2.2 we focus on the organizational context and the KM part (which we call the Knowledge Governance Framework) and in section 2.3 we discuss the measurement part.

2.2. Organizational Context: The Knowledge Governance Framework

Gongla and Rizutto [2] introduced the IBM KM framework 'to link or align a community with the organizational goals, management, value system, and infrastructure'. We add to this model by distinguishing different types of management activities, together regarded as 'knowledge governance'. Peterson [25] reviewed 'governance' in the IS and management literature. Every organization has an implicit or explicit vision and strategy, based on which business objectives can be set. To reach these goals, controlling the KM processes is very important. How to systematically control these processes is addressed with the term 'governance' .

We therefore define knowledge governance as the process of controlling knowledge resources aimed at achieving organizational objectives. Our Knowledge Governance Framework defines the organizational context of KM processes. It distinguishes between three levels of KM in the organization: operational KM, Maintenance KM, and Long-Term KM. In figure 2, these levels, their interrelationships, and the relationship with organizational context are explained. Links between

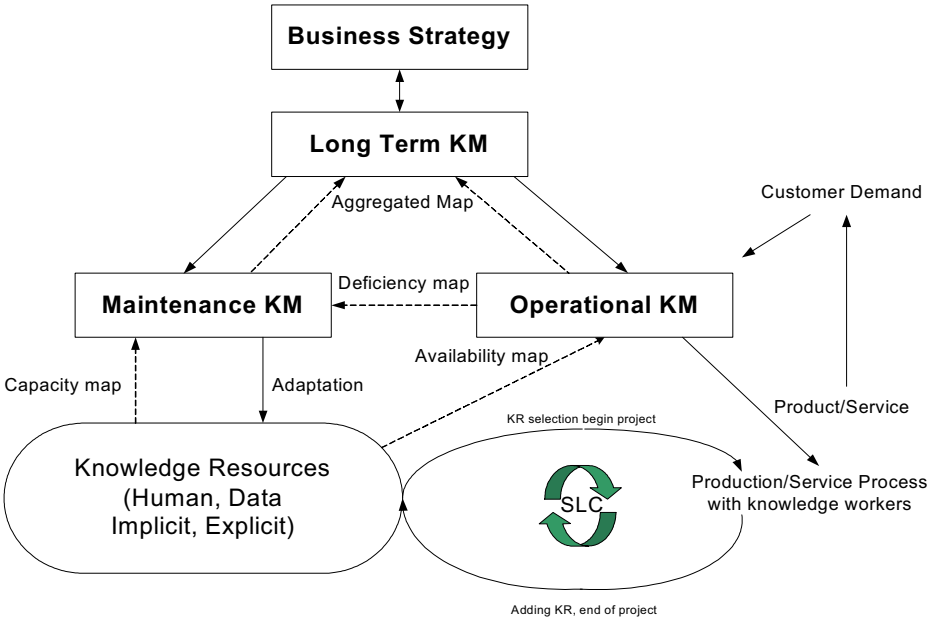

Figure 2. The Knowledge Governance Framework

elements are either *control processes*, such as adaptation, or *maps*. A map is a collection of relevant indicators of knowledge resources to be used in a KM process.

Note that these three levels might be combined in one professional (in a small firm) or distributed among many professionals, managers, or departments (in larger firms).

Operational KM. An operational knowledge manager takes care of the customer demand for knowledge intensive products or services and forms a project team consisting of knowledge resources and specialized employees who will implement these orders. After a customer request has been received, operational KM needs an availability map, an up-to-date overview of the free and available knowledge resources to create an optimal project team. If there is a difference between the actual needs of Operational KM and the available resources, the gaps will be communicated to Maintenance KM via the deficiency map.

Maintenance KM. A maintenance knowledge manager maintains an optimal level of knowledge resources by comparing the capacity map, the total set of knowledge resources present in the organization with the deficiency map. As a result, the knowledge resources may have to be adapted. This can be realized, for example, through training, hiring, buying, development of knowledge products, social learning, and linking to other resources.

Long-Term KM. A long-term knowledge manager evaluates summaries of Maintenance and Operational KM in the form of aggregated maps. These results will be matched with the business strategy and objectives, so that a long-term planning can be made. This planning, which is communicated to the other KM processes, contains the KM objectives to be reached and the costs and profits that will be realized.

Grover and Davenport [8] edited a special issue of the Journal of MIS on KM fostering a research agenda. They distinguish between a process framework and a market framework for KM research. The process framework is a pragmatic one in which the knowledge generation process (including codification, transfer, and realization) is used to guide research on 'how knowledge creation and use can be managed'. The market framework takes a transactional perspective where knowledge exchanges occur in a market place [6]. The market framework uses concepts such as information asymmetry, efficiency of markets, and standardization, thus framing KM as the problem of creating an effective and efficient knowledge marketplace. The knowledge governance framework fits the process framework since it focuses on how knowledge creation and use can be managed.

2.3. Knowledge Aspects: SECI and Intellectual Capital Method

We now focus on measurement in KM. Knowledge aspects concern the key KM concepts that can be measured with indicators. Two key classes of these concepts are the knowledge creation *processes* and the knowledge *products* created. The processes are the four SECI processes of socialization, externalization, combination, and internalization. To classify the knowledge products that are being used and produced in these processes, we turn to the Intellectual Capital method.

The Intellectual Capital method [22] allows one to measure intangible resources, like knowledge and knowledge growth. The method first structures intangible knowledge, and, second, provides an adequate way of measuring knowledge. Its main distinction is between financial capital (monetary resources) and *intellectual capital* (intangible resources). In turn, intellectual capital is subdivided into *human capital* (the expertise of employees) and *structural capital* (intangible resources in organization). The IC method identifies the relevant categories of intellectual capital, their critical success factors and metrics.

There is a similarity between Human Capital and Tacit Knowledge on the one hand, and between Structural Capital and Explicit knowledge on the other hand. Human Capital can be further subdivided into Operational Knowledge and Sympathized Knowledge (categories of Tacit Knowledge). Structural Capital, in turn, is subdivided into Conceptual Knowledge and Systemic Knowledge, both examples of Explicit Knowledge

Diagnosis means comparing actual with desired (benchmark) values and giving a proposed course of action to address underlying problems. In our approach, we have two diagnostic approaches: a simple indicator value comparison, and a systemic analysis of learning problems, based on Senge's systems view on the learning organization. In the next section, we will explain and apply the first approach; here we will outline Senge's approach.

Senge [12] sees the organization as consisting of *circles of causality*, which amplify or stabilize processes of, in this case, KM and organizational learning. Senge has identified several archetypes of problems – and their solutions - in these circles, such as 'limits to growth'. This is an illustration of an initial growth process that comes to a standstill by an emerging stabilizing process. An example is a company startup that initially grows explosively, but then slows down because there is a lack of managerial skills. The solution would be to reduce the stabilizing proces, in this case to increase the number of managers.

In our view, Nonaka's cyclical knowledge creation process is basically an amplifying process. Using Senge's archetypes, anomalies in KM processes can be detected, and solutions can be prescribed.

The knowledge governance framework is further operationalized with a questionnaire consisting of five open questions to be applied in interviews with managers in case studies. Case analysis is furthermore based on documents, web, and desk research [23]. The five questions are:

(1) What are the key knowledge resources in your company?

(2) Which communities (of practice, interest or others) are relevant for your company?

(3) With respect to Operational KM: Who decides which (knowledge) resources will be assigned to a project (customer/ product/ process)? How does this person determine the amounts and types of resources needed? Which goals does she want to achieve? How are the goals evaluated? How is the availability of (free) resources indicated? In case of lacking or insufficient resources: how and with which person(s) is this communicated? Does your company (managers) use specific threshold values for resources?

(4) With respect to Maintenance KM: How are knowledge resources created? Who maintains the resources, and how does maintenance take place? How is the availability of resources indicated? With which person(s) does communication take place on necessary knowledge resources? What are the objectives of these people? In case of lacking, insufficient (or excess of) resources: how and with which person(s) is this communicated? Does your company (managers) use specific threshold values for resources?

(5) With respect to Long term KM: How is KM linked to business objectives and business strategy? (e.g.: Why did your organization start the Intranet (community of practice)?) How is the availability of knowledge resources indicated on the organizational level? In case of lacking or insufficient resources: how and with which person(s) are these communicated? Does your company (managers) use specific threshold values for resources?

3. Applying the framework to a case

We applied the framework to a typical case: FP, a young company in which a community of practice plays an important role. The basis of this analysis is a case study done by Dijkstra [20] and, after one year in 2003, a review of his findings. In the current presentation of this case study, we made a number of simplifications in our approach: (1) in the knowledge aspects, we only examine SECI constructs of knowledge process and product, no complex Intellectual Capital concepts, (2) from the Knowledge Governance Framework, only Operational KM is analyzed (interview questions 1 and 3), (3) for diagnosis purposes, only the simple indicator value comparison is presented, not systemic analysis using Senge. For more details on the application of the Intellectual Capital method and Senge's theory to the case, we refer to Dijkstra [20].

3.1. The Case: FP

FP is a Dutch organization operating in the investment fund industry. Investment funds are highly complex and knowledge intensive products, with many specialized roles, such as brokers, portfolio managers, various kinds of analysts, and fund sponsors, accountants, administrators, and custodians. FP acts as an intermediary in this web of roles. FP is a young company, established in 2000, when around 15 experts in different fund domains were employed from three large financial institutions. FP had about 20 staff in 2002. The basis of the organization is the team of investment fund specialists, who form the majority of employees.

The core activity of FP is the design and development of specific investment funds (e.g. hedge funds) for distributors and large institutional investors. The second main activity is the development and exploitation of an e-business portal aimed at making transparent the investment fund industry and sharing knowledge. By doing so, FP aims to become the hub in a network of expertise. Suppliers are all parties, like those mentioned above, who contribute financial and management services (such as fund management, custodian services, securities management) to an investment fund. Distributors are organizations like banks and pension fund organizations that offer investment funds to investors, such as end-consumers and financial intermediaries.

Apart from the development and maintenance of the e-business portal, activities are organized around fund development projects. All FP specialists have their own expertise in the development of investment funds, and are responsible for selecting and communicating with the specific suppliers related to their field of expertise. Since FP is a small organization, with a high degree of interdependence and collaboration between its members, a de facto community of practice exists. However, there is room for further optimizing structure and operations of this community, something of which the organization is well aware.

FP is a niche player in the financial market, offering specialized services. Its core competence is described as 'the expertise to develop tailor-made investment funds, requiring the ability to anticipate on trends in the investment fund industry' (such as 'hedge funds', 'click funds', 'sector funds', 'self select funds'). To be able to do so, continuous innovation is required. Thus, FP can be considered a knowledge intensive organization in which knowledge is the key asset that needs to be properly consolidated (figure 1), in which there is a de facto community of practice, and in which new knowledge needs to be continuously created for the company to survive. It is thus a good candidate as a case to apply our theoretical framework.

The only real community of practice in FP is the internal network of experts. There are no communities between FP and its clients or communities around products or processes, no communities around literature, and no living discussion groups on financial themes relevant to FP. Most external relationships are characterized by single channel client-provider communication. Other possible communities would be regular specialist meetings (seminars etc), creating a discussion platform for the issues in the pension world (through their yearly non-commercial pension summit and discussions with regulators, pension funds etc). FP does not know why these communities do not exist, but assumes that it does not fit the financial industry culture.

3.2. Knowledge Management in FP

The output of our approach is a judgment of to what degree KM in the community of investment fund specialists is effective. It provides a systematic way of arriving at such an assessment.

Knowledge Resources. A wealth of knowledge resources is available in FP: human resources comprise the various investment fund specialists and their personal networks, the data resources include raw data sources like the financial literature, news papers, and journals. Intermediate data sources such as news bites and headlines are automatically created out of the raw data. Final data products are stored on the web portal and intranet.

Knowledge Creation and Development. All SECI processes and their respective outputs of sympathized, conceptual, systemic, and operational knowledge were examined for operational KM. The ultimate knowledge products are the various investment fund products. A quick scan of the guidelines for effective knowledge creation was made, the results of which can be found in (Dijkstra, 2002).

Organizational Context. The focus of this first analysis was especially operational KM: what is needed to create the investment fund products? Currently, the other parts of the Knowledge Governance Framework are researched in the FP case.

3.3. Measuring Knowledge and KM in FP

Knowledge Aspects. In the current case, the knowledge aspects researched were only the basic SECI processes and products. Special attention, however, needs to be paid to specific key success factors of communities. In future research, more community-specific aspects will therefore also be researched. One key factor often used for community assessment is sociability, which is defined as the extent to which the social policies incorporated by the information system support the purpose of the community and are understandable and acceptable to its members [1].

Indicators. For each of the critical success factors, a set of indicators needs to be developed. The indicators presented here are not based on theory, but were constructed in dialogue with FP representatives. In future research, it might be interesting to examine how they relate to more theoretically grounded approaches to indicator construction, such as proposed in the quality literature (e.g. [24]). However, these indicators, although possibly not complete and theoretically justified were (initially) considered valuable in practice, so they deserve further investigations.

Indicators for socialization. Socialization leads to *sympathized knowledge*, which is tacit knowledge shared through common experiences. Examples are organizational skills and know-how, and trust between members of the organization. This tacit knowledge cannot be measured directly. Indirectly, however, it can be assessed by measuring the socialization process itself. The following three indicators were considered relevant by employees to measure the physical and regulating facilities for socialization:

- *Direct communication links:* the average percentage per member of the specialist team of other team members who work in the same room versus the total number of team members. A high percentage is desired, as it is conducive to informal interaction and thus socialization.
- *Non-assigned working time*: the average percentage per member of the organization of the hours not used for meetings versus the total number of working hours (in the past 30 days). A high percentage is positive for socialization, as it generally takes place during non-assigned working hours.
- *Regulated socialization:* the percentage of formally regulated hours in which socialization can take place versus the total number of working hours (per week). One can think of meetings in which professional communication takes place such as seminars, CoP discussions, non-project-oriented meetings, etc. A high percentage is desirable. The importance of a high value for this indicator gets higher if the values for direct communication links and non-assigned working time are lower.

Indicators for externalization. The output of externalization is conceptual knowledge. Two indicators are presented. The first one directly measures the amount of conceptual knowledge. As this is a very broad indicator, a second indicator is introduced which focuses on the process of externalization.

Table 1: Knowledge creation indicator values for FP

CATEGORY	KNOWLEDGE CREATING PROCESS	INDICATOR	VALUE (T0)
Sympathized knowledge	Socialization	Direct communication links	100%
		Non-assigned working time	68%
		Regulated socialization	2,4%
Conceptual knowledge	Externalization	Number of bytes of project docs	47,5 Mb
		Percentage of hours assigned to project meetings	15%
Systemic knowledge	Combination	Number of categories in KB	3
		Number of items in KB	2071
Operational knowledge	Internalization	Number of years experience	9,6
		Frequency of use of KB	39,4

- *Number of bytes of project documents:* the total number of bytes that project meeting documents consume. Project meetings are regulated facilities for externalization. The size of the project documents gives a rough indication of the degree to which conceptual knowledge has been worked out.
- *Percentage of hours assigned to project meetings:* the average percentage of hours of a working week assigned to project meetings. A high percentage is positive for externalization, because much of it takes place in dedicated meetings. There is a negative correlation with the non-assigned working time. A balance between the values of both indicators needs to be found.

Indicators for combination. The output of combination is systemic knowledge. The following indicators can directly indicate the amount of systemic knowledge:

- Number of categories in the knowledge base: the total number of categories in which knowledge in the knowledge base is subdivided. The knowledge base is (in FP) the most important implementation of systemic knowledge.
- Number of items in the knowledge base: the total number of items stored in the knowledge base, such as tuples, instances, etc.

Indicators for internalization. The output of internalization is operational knowledge. Both indicators measure the process of internalization.

- *Number of years experience:* the average number of years experience in the investment fund industry for the organizational members. It measures how long people have been involved in obtaining hands-on experience in learning about their trade.
- *Frequency of use of the knowledge base:* The average number of times the knowledge base has been accessed (in the past 30 days). As people use this to learn about new concepts and apply it directly in their work, this is quite a precise indicator for internalization.

Values and Diagnosis. Table 1 shows the four types of knowledge and the related process, the indicators, the obtained values. After one year, the indicators and values of table 1 were evaluated in an interview with the senior FP manager also involved in the development of the values in 2002. It turned out that these values were not used (anymore). Further analysis showed that FP distinguishes between the following five knowledge categories, of which some aspects can be made explicit (without FP keeping track of the values of the aspects):

- Knowledge on specific fund types (the products of FP and its competitors). FP sees this as a key resource and has several large databases on different fund types. This is explicit knowledge.
- Knowledge on how funds can be created (the FP 'production process'), using services of various (but a limited number of) suppliers such as custody services and fund administrator services. FP keeps details in a simple database. This is explicit knowledge.
- Knowledge in people (FP personnel) of which some are experts in specific products, others are experts in financial processes. This is tacit knowledge.
- Knowledge on FP customers: FP keeps a large database on the customers (pension funds, banks, integrated asset managers), including emails, letters, contacts etc, to enable reports on customers and on processes, such as 'status of leads', 'current and previous relations', 'status of the order pipeline or projects per customer'. This is explicit knowledge.
- Knowledge of financial markets including knowledge of hypes. The market of making and selling funds is an example of a slow market. FP has structured the knowledge on the financial industry in more or less fixed themes that form the basis for the database (portal) and the automatic text categorization. This is explicit knowledge.

Interestingly, FP has recently decided not to include hype-themes in the database, nor to hire hype-experts to expand the human resources. FP has concluded that the best business chances would come from using the available resources (being the existing database themes and existing experts).

4. Discussion and Conclusions

Although a large body of literature exists on KM in general, and –more recently- on the role that communities of practice play in knowledge development, so far not much specific theory has been formed about KM in communities of practice. Also, not much has been published on the role that performance indicators and measurement play in this context.

In this paper we presented the Knowledge Governance Framework, which combines knowledge resources, KM, and organizational objectives. More specifically, we focused on how to define, measure, and use performance indicators for KM. Furthermore we have outlined an approach to analyze KM in a community of practice. The approach is based on the literature on (i) *types of knowledge,* (ii) processes of *knowledge development and social learning*, (iii) *levels or types of KM* in an organization, and (iv) *metrics* to enable effective KM.

Our aim is to examine successful case studies and to develop useful and practical guidelines for KM procedures.

Our contribution is that KM processes can now be embedded in an organizational context. Our first hypothesis was that KM in communities of practice can only be successful if it links knowledge resources to organizational objectives. Our second hypothesis was that successful KM can only exist if explicit, quantitative indicators are used. We tested the framework in a case study and did a preliminary test of both hypotheses.

We have applied the approach in a small knowledge intensive organization (a community of practice) in a knowledge intensive industry (financial services). According to this first experience, the model can be applied in a business setting. Our first hypothesis is supported: knowledge resources are linked to company

objectives, as clear dependencies via the various KM processes could be identified between organizational goals and the main knowledge categories: for example, the goal of providing state of the art investment fund knowledge is connected to the tacit expert product knowledge through regulated socialization processes in which experts become aware of this expertise.

Our second hypothesis is not supported: KM in the case is not based on very explicit and quantitative indicators.

Our first investigation into KM measurement in 2002 in the FP case (Table 1) was to list quantitative indicators linked to Nonaka's knowledge categories and knowledge creating processes. Evaluation of the list after one year showed that (i) FP used other categories, and that (ii) only some of these are measured in some explicit form. We found that FP distinguished between five knowledge categories, not related to the Nonaka categories, but resembling the basic categories (knowledge on products, production processes, suppliers, and customers) listed in the Intellectual Capital method.

Our methodology aims at theory construction, only partially theory testing. One limitation is that in our first case we did not find many community-specific elements yet. In the case studied (FP) the community almost equals the organization. Furthermore, many KM processes are embodied in only a few persons. We therefore plan to apply the knowledge governance framework in other knowledge intensive organizations, including a large organization and a mid-sized one. In these organizations, multiple communities are present that do not overlap with organizational boundaries. We will also pay more explicit attention to the various knowledge maps. To produce the required KM maps, we will experiment with knowledge representations of different degrees of formalization, such as task ontologies, as well as with project resource planning methods. Finally, we will also pay more attention to quality of indicators, and the precise - and possibly different - role that they play in larger organizations in which communities of practice are positioned differently.

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