

What is Organizational Knowledge Maturing and How Can It Be Assessed?

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Abstract: We introduce the concept of organizational knowledge maturing based on the idea of developing knowledge assets. We explain the dimensions that have to be considered and introduce the Knowledge Maturing Dimension Framework to measure the maturity level. Finally we describe service classes as the building blocks of a future organizational learning and maturing environment (OLME).

Keywords: Organizational Knowledge, Knowledge Maturing, Knowledge Assets, Knowledge Maturing Dimension Framework

Categories: L.0.0, M.2, M.3

1 Introduction

Knowledge is the key factor in every organization. Whereas in former times machines have been the key asset of a company since more than two decades knowledge has clearly taken this role. Undoubtedly knowledge is needed to perform the business tasks correctly and efficiently and managing organizational knowledge is as important as managing the business processes. However, it is not enough to manage existing knowledge but also to mature it in order to keep pace with (continuous and even accelerated) business changes. Therefore it is important to clarify what knowledge maturing is and what it means in an organizational context.

The question what knowledge maturing means, is related to the problem how to identify knowledge assets (KA), which appear as artefacts, cognifacts, and sociofacts [Nelkner, 09], and how to measure the existing levels of knowledge maturity, regardless whether the focus is placed on a whole organization, an organizational unit, or just a certain topic. To this end we introduce the Knowledge Maturing Dimension Framework (KMDF).

As we know what knowledge maturing is and what the current status in an organization is, we can define methods for knowledge maturing and support the development of maturing services. In the following we describe (individual and organizational) knowledge as rational capacities and show its close relation to action. Then we introduce the knowledge maturing process and describe its consequences for organizational learning. Furthermore, we describe knowledge assets and maturing

stages as well as the KMDF and compile the maturing services as basis of a future organizational learning and maturing environment (OLME).

2 Knowledge and Knowledge Maturing Concept

There are two different views on knowledge: one is *subjective* and regards knowledge as a dynamic concept focussing on process and contextual aspects; the other is *objective* and sees knowledge incorporated in documents and other artefacts independent of any human interpreter [Nonaka, 06]. The approach to knowledge that we apply takes both aspects into account as we will show in Section 2.2. The central assumption is that we need knowledge because it is a precondition for action [Riss, 05]. This holds for individuals as well as for organizations.

Starting from the concept of action, we understand it as a process of intended concretion of an actor's goals based on the actor's respective capacities. Actors can be either individual persons or organizations. The relation between action and knowledge we refer to has been recently discussed by [Kern, 06], arguing for the characterization of knowledge as rational capacity. This view emphasizes the fact that a capacity (and so knowledge) only becomes manifest in its actualization. The decisive difference to the objective concept of knowledge consists in the insight that knowledge is not a static resource that is stored in databases but that it is intrinsically entwined with action. On the other hand, the concept reveals that knowledge cannot only be identified on the basis of artefacts such as documents or models but also indirectly on the basis of performed actions. In this way both explicit and implicit knowledge can be taken into account [Polanyi, 66] in the knowledge maturing process.

We will show that these considerations possess a considerable relevance for the way how we understand and support knowledge maturing. To understand knowledge maturing, we first have to look at the concept of learning, i.e., acquisition of knowledge. According to the concept knowledge as rational capacity to act we distinguish two modes of learning [Reber, 93; Eraut, 04]:

Implicit Learning: By continuous actualization of a capacity the respective knowledge develops further. Such development can be due to changing demands coming from the agent's environment, e.g., increasing the complexity of the respective actions. Such a development can finally lead to qualitative change in the agent's capacity. For example, an occasional writer can become a professional author.

Explicit Learning: Another way to acquire new knowledge is by instruction. In this case the agent learns to perform new actions by following explicit descriptions while actualizing other already existing capacities. By repeated combined actualization the respective capacities usually merge to a new capacity.

The knowledge maturing process [Schmidt, 05] is distinguished from mere learning by the fact that it regards individual and organizational knowledge development as directed, i.e., derived from and coordinated with respect to an organizational context. This does not mean that all personal learning is determined by the organization but that the organization takes all forms of learning into account and tries to leverage synergies between them. Although learning always takes place in organizations it is an observation that it is not consequently fostered in an organized and systematic way today [Schmidt, 09]. The central challenge that we face in this

respect is the large variety of different learning types and styles and their general relevance to organizational knowledge maturing. [Maier, 08].

In the following we want to investigate how a maturing process based on a concept of knowledge as rational capacity can be realized in an organizational context.

2.1 Organizational Knowledge Maturing

The knowledge maturing process [Schmidt, 05] is distinguished from learning by its focus on knowledge development in an organizational context or more specifically as a knowledge development process guided by the organization. Although learning takes place in every organization it is an observation which does not happen in an organized and systematic way but rather spontaneous [Schmidt, 05]. We will investigate how a maturing process can be realized in an organizational context. An organization must be seen as a system with complex internal processes that, however, appears as a whole to the external world.

The capacity of the organization is determined by the individual capacities of its members but also by the coordination and communication capacities of the organization itself. Obviously the organizational knowledge goes beyond the collection of individual knowledge. The concept of knowledge as a rational capacity of an agent and not as a state plays a major role in this respect since capacities rely on the process of actualization and develop with these actualizations. Moreover, it emphasizes the fact that knowledge can be recognized on the basis of users' activities, even if the knowledge itself might not become manifest in any form. Third it realizes that the transfer of knowledge is not generally realized by the provision of corresponding knowledge artefacts but requires action. [Orlikowski, 02] stands for a similar view stating that knowing is not a static capability or stable state of actors but a dynamic social entity that results from the entwined practical engagement of actors in the organization.

In the MATURE project we investigate the knowledge maturing process with respect to three different levels: the individual level, the community level, and the organizational level. Here we distinguish communities from organizations by the fact that organizations aim at joint action whereas communities only aim at the exchange of experience. Maturing processes take place at all three levels. There are two targets that the maturing process addresses: the individual member who is to be supported by a Personal Learning and Maturing Environment (PLME) and the entire organization supported by an Organizational Learning and Maturing Environment (OLME).

In order to establish a coordination of organizational knowledge development, we first have to consider in which form organizational knowledge can develop. Here we can identify three types:

Organization Indwelling: This aims at the continuous improvement of organizational capacities due to continuous actualization and further development induced by continuous changes in the environment. The decisive task of the OLME with respect to Organizational Indwelling consists in making the development of the organizational capacities transparent for the organization, i.e., in particular for its management.

Knowledge Gaps: Often the requirements that are enforced by the organizational environment cannot immediately be answered by the organization due to missing

knowledge. Here the central task consists in the identification of upcoming organizational knowledge gaps and suggestion how to address the problem, e.g., by offering training for individual members or buy-in of external expertise as individual persons or entire organizations.

Upcoming Opportunities: Generally the knowledge of the individual members in the organization covers aspects which are not realized and leveraged by the organization since they might be out of scope. However, such capacities provide opportunities for future organizational development, e.g., new technological trends may appear in the capacities of the individual members at an earlier stage than they are recognized by the organization. In this respect it is the task of the OLME to identify such opportunities.

In order to fulfil these requirements the OLME must provide services that support the respective knowledge maturing tasks. However these services must operate on available information sources that can provide the data for the required analysis, as indicated above. In the following we will turn to these information sources and how they can be analyzed.

2.2 Artefacts, Cognifacts and Sociofacts as Knowledge Assets

In order to find information about capacities in an organization we have to identify knowledge assets related to these capacities. [Nelkner 09] provides some theoretical background how to find a categorization of these carriers as artefacts, cognifacts, and sociofacts. In the following we refer to this approach pointing at its organizational aspects. The KA can be described in the following way:

Artefacts consist in codified information that can enable members of the organization to acquire new capacities. Artefacts are not capacities but they can be regarded as enablers of capacities. Often this requires additional communication. A central development step for artefacts consists in the access to private artefacts. They must be identified in organization without violating individual privacy demands.

Cognifacts refer to the individual expertise of individual member in the organization. Since cognifacts as individual capacities are not directly accessible they can only be indirectly identified by the corresponding actions. Although competency management systems are available a formal description of skill is often difficult and vague. Here activity-based competency systems offer more opportunities, i.e., competencies are determined on the basis of activities or tasks that a person has accomplished.

Sociofacts are even more difficult to identify since they represent collective capacities. Nevertheless there are various ways to get information about sociofacts, e.g., the identification of communities of practice. We can also investigate collaborative actions or tasks, e.g., the development of a new product or the organization of a workshop. As in the case of cognifacts sociofacts can only be determined through their effect on the organization.

According to the capacity approach the maturing of knowledge is often related to the actualization or application of capacities. Such actualizations can point at further requirements (e.g., if specific tasks cannot not be effectively executed) or at opportunities (e.g., if persons performed tasks outside the organizational scope). In this sense activities are general indicators for the maturity of artefacts, cognifacts, and sociofacts, even if the two latter are not directly accessible. Generally an

insufficiently developed capacity is likely to lead to problems in execution. The central challenge consists in the identification of existing or required capacities from the observed activities.

2.3 The Knowledge Maturing Model

The knowledge Maturing process usually develops along different stages which have been described in the MATURE knowledge maturing model [Maier, 07]:

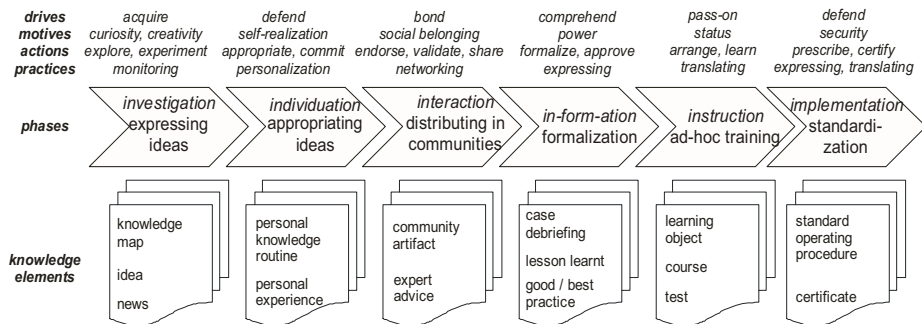


Figure 1: The knowledge maturity model.

We have taken the stages in Fig. 1 as starting point to derive the demands that we find in organizations. Further development of the model is already in progress. Our interpretation of the model results in the following characterizations:

- **Investigation Stage:** Knowledge at this stage is mainly individual, often formulated in an abstract way, and not yet actualized. This also affects the corresponding actions which are often characterized by occurring problems since the capacities are still immature. For the organizational context this stage is often too immature to be suitable for further analysis.
- **Individuation Stage:** At this stage knowledge becomes part of individual activity. This means that it has been actualized several times but has not become general practice or experience. Nevertheless it might happen that the same practice is applied by several persons independently of each other. If this knowledge is codified then usually in personal documents or logs. The corresponding actions are more settled as in the investigation stage but still individual.
- **Interaction Stage:** At this stage a transition from individual actualization to community level appears. This process is accompanied by codification that supports experience exchange. The respective knowledge can be identified in artefacts as well as individual activities. Interaction mainly takes place in peer groups. This means that the knowledge artifacts are not very elaborate since the peers' communication is based on a common understanding. The corresponding actions and capacities spread in peer groups. Corresponding actions are still individual but related information starts to spread within the organization even if it is only comprehensible for restricted groups.

- **Information Stage:** At this stage the codification in artifacts becomes more elaborate and already serves dissemination of the respective information. This is the stage in which collaboration comes into play since the codification supports understanding beyond directly cooperating partners. Typical artefacts for this stage are task patterns [Schmidt, 09].
- **Instruction Stage:** The reached knowledge maturity allows for the dissemination beyond peer groups. Knowledge artifacts reach a stage that allows the transfer of knowledge to novices in a specific area. This stage requires that the respective knowledge has become aware to the organization. Corresponding actions are no longer performed in the respective peer groups but spread due to public access to the respective instructions.
- **Implementation Stage:** The artifact has been standardized to be available for automatic processing or delivery. Since the transition to this final stage is especially costly it requires specific inspection with respect to the expected usage of this asset. At this stage actions are replaced by automated processes.

It is observed, that the transitions between the different stages are fuzzy. Especially the transition between Interaction, Information, and Instruction Stages are often not always clear since in general the respective groups are not homogenous, i.e., there is a continuous transition between peers and novices. In general determination of an organization's level of knowledge maturity is difficult. To address this problem we introduced a multi-dimensional framework to assess the status quo and potentials for knowledge maturing in an organization.

3 The Knowledge Maturing Dimension Framework (KMDF)

Before we can define services for knowledge maturing and assess their potential, we must answer some general questions, e.g., 'Do we know, what we know'? Where do we stand with regard to knowledge availability, use and learning? How can we measure the status quo, how can we support and improve knowledge maturing and how can we measure improvements? What are appropriate learning methods for companies? Which methods and tools can be applied in our environment?

The answers to these questions depend on a variety of influencing factors, ranging from soft factors such as 'trust' to hard factors such as 'documentation'. A lot of research is dedicated to a proper treatment of implicit knowledge in a company but comparable little research deals with sophisticated concepts for maturing existing explicit knowledge. In addition explicit knowledge (i.e. documented knowledge) in any form can be regarded as a good starting point for assessing organizational knowledge and its maturing.

The framework distinguishes six dimensions dedicated to measure explicit knowledge only [Brun, 09]. However, it would be no problem to add further dimensions if appropriate. The current dimensions of knowledge potentials are:

- maturity of knowledge management
- knowledge usage
- availability of information
- maturity of knowledge organization
- information management

- conciseness of knowledge

For each dimension we defined five maturity levels. The sequence of the introduced dimensions is of no importance. To assess the status quo of knowledge management in an organization the multi-dimensional framework can be used. Regardless whether the maturity of the whole organization, of an organizational unit, for all knowledge objects or only for a certain topic each of the dimensions can be evaluated.

The approach has been successfully tested in a small student project, where some processes of an organization have been considered which then were rated with the KMDF. It could be shown where the organization stands and hints could be given for further development of the maturity of knowledge. The applicability of the KMDF will now be tested in a larger project.

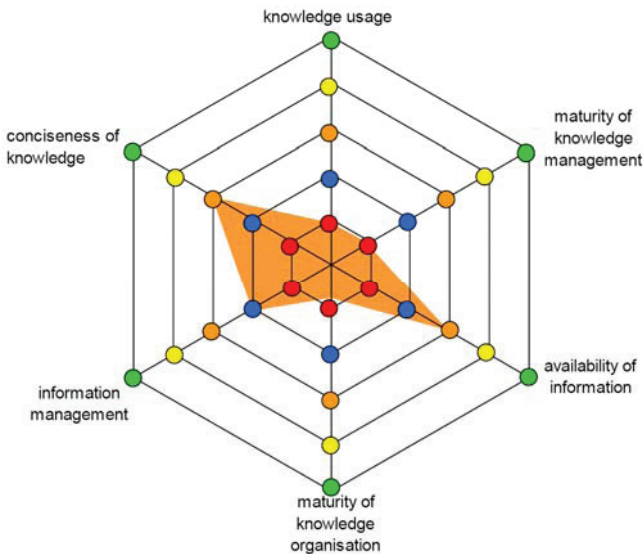


Figure 2: Example of a Knowledge Maturing Assessment using the KMDF.

In the following we shortly describe each dimension and directly give an example how the framework can be used. Let's assume a project team wants to assess the status quo of their knowledge management to reach better performance. All project members have access to the project information via a project wiki. Documents are shared using SVN. Remote meetings are held using a collaboration tool; all meetings are recorded, minutes are taken and published in the wiki. Fig. 2 gives an example how the Knowledge Maturing Dimension Framework is used to illustrate the assessment.

1. The **'knowledge usage'** dimension assesses the integration of knowledge management activities into the operational work. This dimension corresponds to the integration of process and knowledge management which is the main focus of process-oriented knowledge management [Abecker, 02]. To reach the lowest level of maturity (level 1) as in the example it is

sufficient that finding relevant knowledge is supported by general-purpose search engines, information is exchanged via email or using a collaboration **tool**.

2. The dimension '**availability of information**' comprises levels from explicit documentation, transparency, accessibility, integrated information up to automated metadata generation. The example shows that level 3 of maturity is reached for this dimension as all (project) relevant information can be accessed directly e.g. via the intranet portal.
3. It is the objective of '**maturity of knowledge organization**' to make knowledge intellectually accessible by using a conceptual structure that makes large amounts of knowledge assets comprehensible and manageable. Knowledge organization deals with (1) building and modelling systems of concepts as well as (2) their mapping to subjects of reality. Methods for knowledge organization can be arranged in a spectrum with increased semantics. In the example at that time there is only a weak conceptual structure of the project knowledge repository, mainly the organization of the project wiki.
4. The dimension of '**information management**' considers the structure, security, redundancy, integrity on conflict resolving of information and classifies five constructive levels. Looking at the example considering structure and security it can be said that level two is reached. That means that (project) information is structured (in the project wiki) and its access is protected by a login.
5. There exists no standardized description scheme for '**conciseness of knowledge**' in the literature. A valuable source which is appropriate for our purpose is the list of criteria for measuring the information quality given by the DGIQ¹. Our approach was to select the following eleven criteria in order to assess the quality of content. (The rates accord the example; 1-5):
 - Appropriate Amount: rate 5 (the amount of information satisfies the projects requirements)
 - Believability: rate 5 (all information is validated by project members)
 - Completeness: rate 5 (information is complete for adequately performing a certain task)
 - Concise representation: rate 2 (the relevant information is provided in an adequate and easy-to-handle format).
 - Consistent representation: rate 2 (the same information, e.g. the documentation of an idea, is presented in different ways and a lot of information is in the state of development and still has to be consolidated).
 - Ease of manipulation: rate 3 (the effort for changing and adapting information using a wiki and SVN is not very convenient).
 - Unambiguous Interpretability: rate 4 (there is a clear interpretation what to do for the information provided).
 - Objectivity: rate 5 (information is value-free and based on facts).

¹ Deutsche Gesellschaft für Informations- und Datenqualität, German association for information and data quality (transl.)

- Reputation of Source: rate 5 (the source of information and the processing system are highly reliable).
- Timeliness: rate 5 (the information provided is up-to-date).
- Understandability: rate 2 (the information is easy to understand by the targeted audience with respect to the consortium's member but not by the associate partners, especially not by the application partners).

The overall conciseness of knowledge has an average weight of level 3.

6. The '**maturity of knowledge management**' is related to the quality of the knowledge processes and the knowledge organization. The KMMM[®] (Knowledge Management Maturity Model) is an example for assessing knowledge maturity levels [Ehms, 08], [KMMM, 09]. For the example an initial level is reached by organising the (project) knowledge in a structures way (within the project Wiki).

Based on the evaluation of the status quo, it is possible to identify weaknesses and strengths as well as maturing goals and strategies. On this basis we developed 5 classes of **Maturing Services** to support the maturing process to implement a maturing process in an organization:

Monitoring Services: They identify new or changing KA and their relations as the basis for goal-oriented maturing measures;

Integration Services: They ensure the consistency of KA and aim at the resolution of knowledge island, e.g., communities dealing with the same topic but unaware of each other or matching of knowledge needs in activities and hidden KA that could support these activities;

Refinement Services: They support the development of KA with a specific focus on the aggregation of knowledge provided by maturing services and offered to the developer of KA;

Dissemination Services: They ensure that KAs are transferred to the requesters or other people in the organization who are affected by them;

Negotiation Services: The previous services are supported by additional negotiation services in order to tackle problems that cannot be resolved automatically.

The 5 service types are related to the model provided above. This becomes clear if we consider these services in more detail as in the examples of monitoring services. The full specification of these services, however, will be accomplished in the ongoing work of the project MATURE.

4 Conclusions

We have shown that organizational knowledge resembles individual knowledge in many aspects, in particular regarding its relation to action. This relation is expressed in the characterization of knowledge as rational capacity to act. It does not only specify the goal of knowledge but the way how we can identify knowledge in an organization. We have explained the difference between organizational learning and knowledge maturing and explained how knowledge becomes manifest in three different knowledge assets (KA): artefacts, cognifacts, and sociofacts. Moreover, we

have pointed out that KA develop along 5 knowledge dimensions, described in the Knowledge Maturing Dimension Framework.

Generally it is not useful and not even feasible to mature all knowledge dimensions in an organization at the same time. Therefore the Knowledge Maturing Dimension Framework helps to check whether necessary preconditions of the knowledge maturing process are fulfilled. Identifying weak (or strong) dimensions is essential for supporting the maturing process. Knowledge as rational capacity to act holds true for knowledge maturing itself: knowing of its facilities is a condition for implementing maturing services.

Thus, we have identified three classes of maturing services supporting *monitoring, integration, refinement, dissemination, and negotiation*. These services work on the different KA and implement the maturing process along the known stages. They are derived from the introduced theoretical background and we regard them as the basis of a future OLME.

Acknowledgements

This work was has been funded by the European Commission as part of the MATURE IP (Grant FP7-216346).

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