Organizational Adoption of Enterprise Modeling Methods – Experience Based Recommendations

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Abstract. Organizations normally begin using Enterprise Modeling (EM) within the context of a development project of some sort, where an outside vendor and/or consultant provide the method and related IT tool usage competence. If an organization uses EM sufficiently frequently it may be motivated to develop in-house EM competence and to acquire and adopt an EM method. The paper is an experience paper. It defines what it means to adopt an EM method in an organization and describes the process of adopting and institutionalizing EM as an organizational strategy to support continuous improvement and development. The process consists of three activities: deciding that an EM method should be adopted as part of the organization's set of institutionalized methods, electing a suitable method and implementing the method.

Keywords: Enterprise Modeling, method adoption.

1   Introduction

Enterprise Modeling (EM) is a process where an integrated and negotiated model describing different aspects of an enterprise is created. An Enterprise Model consists of a number of related "sub-models", each describing the enterprise from a particular perspective, e.g., processes, business rules, goals, actors and concepts. There are three main reasons for organizations to use EM [1].

To develop the business. This entails, e.g., developing business vision, strategies, redesigning business operations, developing the supporting information systems, etc. Business development is one of the most common purposes of EM. It frequently involves change management – determining how to achieve visions and objectives from the current state in organizations. Business process orientation is a specific case of business development – the organization wants to restructure/redesign its business operations.

To ensure the quality of the business operations. This purpose primarily focuses on two issues: 1) sharing the knowledge about the business, its vision, and the way it operates, and 2) ensuring the acceptance of business decisions through committing the

stakeholders to the decisions made. Two important success factors for ensuring quality are that stakeholders understand the business and that they accept/are committed to business decisions. Knowledge Management (KM) is often integrated with day-to-day business processes in organization. KM systematically deals with creating, maintaining and disseminating organizational knowledge between stakeholders. Sharing business knowledge becomes instrumental, e.g., when organizations merge or collaborate in carrying out a business process. A key aspect of this is terminology. EM has a role to play here as it aims to create a multifaceted "map" of the business as a common platform for communicating between stakeholders. One KM perspective is keeping employees informed with regard to how the business is carried out. Most modern organizations consider that the commitment of stakeholders to carry out business decisions is a critical success factor for achieving high quality business operations. Differences in opinion about the business must hence be resolved, requiring that communication between stakeholders be stimulated. EM, particularly using a participative approach, can be effective in obtaining such commitment.

To use EM as a problem solving tool. In this case EM is only used for supporting the discussion among a group of stakeholders trying to analyze a specific problem at hand. In some cases making an EM activity is helpful when capturing, delimiting, and analyzing the initial problem situation and deciding on a course of action. In such cases EM is mostly used as a problem solving and communication tool. The enterprise model created during this type of modeling is used for documenting the discussion and the decisions made. The main characteristics of this purpose are that the company does not intend to use the models for further development work and that the modeling activity has been planned to be a single iteration. In some cases the situation evolves into one of the other EM purposes because the organization sees EM as beneficial or the problem turns out to be more complex than initially thought and more effort is needed for its solution.

EM usually is organized in the form of a project or it is a part of a larger project targeting, e.g., organizational or information system (IS) development.

Organizations normally begin using EM within the context of a development project of some sort, where an outside vendor and/or consultant provide the method and related IT tool usage competence. If an organization uses EM sufficiently frequently it may be motivated to develop in-house EM competence and to acquire and adopt an EM method.

Authors have reflected on the use of enterprise models in organizations from a practical perspective (see e.g. [2]). However, research is scarce into how organizations systematically should proceed to adopt EM. Therefore, the aim of this paper is to discuss the process of adopting EM as an institutionalized way of working and to provide a baseline for further research. It does so based on experiences from a large number of observations from projects using EM as a method. For examples of projects that the authors have been involved in, see, e.g., [3].

The remainder of this paper is organized as follows. Section 2 defines the meaning of organizational EM adoption and institutionalization. The experience base of the paper is described in Section 3. The process of adopting an EM method in an organization is described in Section 4. In section 5 the notion of a modeling department is discussed. The paper ends with some concluding remarks in Section 6.

2   Experience Base

This paper is based on a number of projects carried out since beginning of the 1990-ies:

- Development of the Enterprise Knowledge Development (EKD) EM method [3] (recently refined into the 4EM Method [4]),
- Extensive field work applying versions of EKD to a variety of problems,
- Interview studies involving experienced EM consultants and method developers.

The most influential application cases were, for the most part, carried out within international research projects financed by the European Commission. An overview of the cases is given in Table 1.

Table 1. Overview of main application case**s**

Organization	Domain	Problems addressed
British Aerospace, UK	Aircraft development and production	Requirements Engineering
Telia AB, Sweden	Telecommunications industry	Requirements validation Project definition
Volvo Cars AB, Sweden	Car manufacturing	Requirements engineering
Vattenfall AB, Sweden	Electrical power industry	Change management, Process development, Competence management
Riga City Council, Latvia	Public administration	Development of vision and supporting processes for knowledge management
Verbundplan GmbH, Austria	Electrical power industry	Development of vision and supporting processes for knowledge management
Skaraborg Hospital, Sweden	Health care	Capturing knowledge assets and development of a knowledge map of a knowledge repository.
SYSteam AB, Sweden	Management consulting	Development of a vision for an employee knowledge management portal

Their processes and their outcome were observed and analyzed. Collected data and experiences from method development, fieldwork and interviews were analyzed. In addition, EKD and its earlier versions have also been used in a number of problem solving and organizational design cases at organizations such as e.g. Strömma AB (Sweden), Ericsson (Sweden), Livani District (Latvia), Riga Technical University (Latvia), University of Skövde (Sweden) and RRC College (Latvia).

3   The Meaning of EM Adoption and Institutionalization

In this section we take one step up from the single EM project and consider projects to be part of an organizational strategy to use EM for supporting continuous organizational improvement, i.e., EM becomes institutionalized.

The EM lifecycle can then be outlined according to the following steps [5]. It is also depicted in Figure 1.

1. Something triggers the need to investigate a potential change in the organization. This trigger can be a business opportunity, a challenge, a problem or a symptom of a problem. A choice is made to use EM in the investigation and potentially also to design a change to business operations and/or the IT systems that support business operations.
2. The EM project is initiated and executed.
3. The implementation of the resulting models is planned and executed and the models now become part of the day-to-day business processes.
4. Continuous organizational improvements are made. EM could support some of these improvements. Changes of greater importance will most likely cause the process to start over from step 1.

The outcome or effect of the implementation of models is very much dependent on the following two aspects:

- How the EM project is planned and executed. Management of modeling and model quality is one aspect here as well as the many facets of managing the EM project as a whole.
- How the implementation and continuous improvement of the resulting models is planned and executed over time.

Effectively managing quality throughout the project will ensure that the intended effects of EM and the resulting models will materialize, not only from a short-term perspective but also long-term perspective.
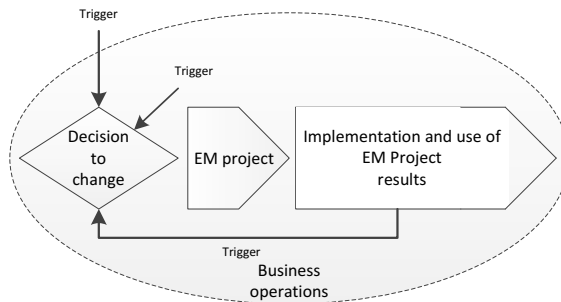

Fig. 1. EM in the context of continuous improvement [5]

When a future state process is implemented following an EM project, a responsible process owner is preferably in control. Measurements are in place and used for continuous follow-up, subsequent rewarding of good process performance and identification of triggers for continuous improvement of organizational operations is made. New opportunities and threats emanating from external or internal sources will challenge or ask for attention and potential new developments, some needing support from EM.

The complete "map" of existing enterprise models will function as important input to future improvement and development projects. This way unnecessary modeling work can be avoided. Even if the organizational context has changed slightly, the existing models will provide a good starting point. Since models will be extensively reused, it is essential that their quality is high. The reuse of models will also require good tool-support that enables change management of models.

The effect of adopting this approach, where EM has an important role, i.e., is institutionalized, is that the process of continuous improvement is kept alive and that external and internal triggers for change are properly analyzed and acted upon.

In order to properly capitalize on the opportunities that this brings, an organization needs be systematic about their approach to adopting EM as an organizational strategy while being aware on the challenges of the adoption process. The EM adoption process will be discussed in the following section.

4   The Adoption Process

In the previous section, an example was given of how EM can become an integral part of an organization's continuous improvement work. In this section we provide an overview of the process of adopting an EM method as part of such an improvement approach. In the following sections, the different steps of the adoption process are discussed in turn.

Despite the advancements in the areas of EM methods and tools, their impact in practice is largely dependent on how they are adopted and institutionalized. EM usage often follows the phases of initial interest, pilot project, and subsequent institutionalization. The most challenging is the final one because at this stage the organization should presumably have enough competence to perform modeling without external support. In cases when this is not so, EM struggles to make positive impact and is gradually forgotten. Therefore, the process of adopting a method should be given the proper attention and resources, in order to be reasonably successful.

In addition, the application of EM is heavily influenced by a large number of situational factors, one of which is the intentions behind its use. We argue that knowledge about these intentions is essential when making decisions about which method, way of working, tool support etc. is appropriate in order for those intentions to be fulfilled.

In [6] we described how the purpose of EM influences the choice of EM language, modeling process, tools etc. (see overview in Table 2.).

The table suggests that if more than one purpose is intended, both the selection process and the adoption process itself becomes inherently difficult, needing tradeoffs to be made between the different purposes.

In some cases it may even be necessary to adopt more than one complementing method to cater for anticipated needs. This in itself requires that the two methods are integrated and that their tool support is also accordingly integrated. This last aspect is a challenge in itself.

Table 2. Requirements on EM [6]. Model types from the 4EM method [4]

Purpose of EM	Input models and documentation	Models to be developed	EM language requirements	EM process requirements	EM tool requirements	Model quality requirements
Develop the business						
Develop visions and strategy	Existing models and other business "blueprints"	Business oriented models, e.g. Goal Model (GM), Concept Model (CM), Business Proc. Model (BPM), Actor Model (AM), inter-model links	Notation that domain stakeholders understand	Participatory	Plastic wall[1], simple documenting tools	Understandability, correctness, simplicity, flexibility
Design/ Redesign the business	Vision and strategy models and other kinds of business "blueprints"	Business oriented models, e.g. as above as well as inter-model links	Established notation that domain stakeholders understand	Participatory involving multiple stakeholder groups	Plastic wall, EM tools that makes it possible to seamlessly move to requirements analysis and IS design	Completeness, correctness, flexibility, integration, understandability, usability
Develop IS	Business oriented models	IS architecture models as well as links with business oriented models	Enough formality and precision to allow modeling of complex facts	Partly participatory and partly analyst driven	Plastic wall, EM tools or CASE tools depending on the development approach	Completeness, correctness, flexibility, integration, usability
Ensure the quality of business operations						
Ensure acceptance for business decisions	Various types of business "blueprints" (e.g. Balanced Scorecard)	Business oriented models (GM, CM, BPM, ARM, BRM) as well as inter-model links	Notation that domain stakeholders understand	Participatory involving knowledge bearers and users	Plastic wall, simple tools, tools for presentation of models	Completeness, correctness, integration, simplicity, understandability, usability
Maintain and share knowledge about the business	Business models (GM, CM, BPM, ARM, BRM), inter-model links	"Cleaned" models that make sense to a wider audience	Simple and intuitive modeling language	Partly participatory, partly analyst driven	EM tools with web interface	Correctness, integration, understandability, usability
Use EM as a business problem solving tool						
To analyze and solve a specific problem or task	Initial problem statement and other relevant documentation	Business oriented models (GM, CM, BPM, ARM, BRM) & inter-model links	Notation that domain stakeholders understand	Participatory involving multiple stakeholder groups	Plastic wall, simple documenting tools	Correctness, flexibility, understandability

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[1] Plastic sheet on the wall where the emerging model is visible to all modeling participants.

The general process of adopting an EM method in an organization consists of the following phases:

- Deciding that an EM method should be adopted as part of the organization's set of institutionalized methods
- Selecting a suitable method
- Implementing the method in the organization

4.1   Deciding that an EM Method Should be Acquired and Adopted

The decision to adopt an EM method as a part of the organization's set of institutionalized methods often originates from the organization having been involved in projects where external consultants have used EM for various purposes, as indicated in the introduction of this paper. This often generates an interest, particularly if the results from such projects have been successful, and a decision to acquire and adopt a method may follow.

4.2   Selecting a Suitable EM Method

The terms modeling method and modeling language are sometimes in practice used as synonyms, which can be confusing. Furthermore, the modeling language itself is not enough to achieve the goals of EM. The user of a modeling language needs guidance for *how* to use the modeling language in a practical context.

Therefore, an EM method is, according to the understanding of the authors of this paper, not an EM method if it does not have two components:

1. An EM language, with a defined syntax, semantics and notation, i.e., the building blocks of an enterprise model. Examples of EM languages can be found, for instance, in [7, 8, 9, 10, 4]
2. An EM process, with a set of recommended elicitation approaches, a set of tools and a project approach which defines how a project using the EM method can be set up and carried out.

We claim that there are very few EM methods that follow this definition, but there are examples, for instance, the AKM approach [7], and the 4EM method [4]. In practice, it may well be the case that the organization is first acquainted with an EM language and wants to adopt it. However, sustainable and successful adoption of EM requires that the organization not only adopt an EM language, with some supporting tool, but also considers and plans for how the modeling process will be managed and also how modeling projects will be organized.

4.2.1   Selecting a Modeling Language

The core of EM is the modeling language because that determines which aspects of a certain problem that can be addressed.

In most cases a certain problem to be addressed can be modeled by using several EM languages/notations. Even within one modeling language the modelers often define "dialects" and sub-notations, i.e., they add elements of secondary notation such as comments, groupings of modeling components, as well as include modeling components from other languages.

The choice of modeling language is to a large extent dependent on the purpose for which EM will be used (see Table 2). The more specific the purpose, the more specialized the language can be. A broad range of intended purposes makes it more difficult to find a language that perfectly fits all purposes. However, there is often room in a language to make adjustments to fit the situation.

When an organization decides to adopt EM as a general method and not only for carrying out a specific project it may be appropriate to select more than one language to cater for intended purposes. E.g. using an EM method for developing visions and strategies and as a general problem-solving tool can require a different level of formality compared to using EM for developing information systems. As a general rule, languages originally intended for developing information systems, e.g. UML, are often more difficult for non-modeling-experts to understand and work with, which suggests that they may not be the optimal choice for problems less formal.

In cases where more than one language is selected, the issue of integration between the languages comes into play. E.g., process models are often part of many EM languages. In projects dealing with information systems development decisions need to be made about which models will be used in the more business oriented part of a project, where understandability is essential, and how these will be used in the more systems oriented part. Adopting more than one modeling language also influences the choice of tools, more specifically computer-based tools. One of many issues here is how models created by using one tool can be integrated with models created by using another tool.

4.2.2   Selecting a Modeling Process

A general process for carrying out an EM project is described in [11]. It contains a number of activities according to Table 3.

Table 3. Activities in the EM process [11]

Define scope and objectives of the modeling project
Plan for project activities and resources
Plan for modeling session
Gather and analyze background information
Interview modeling participants
Prepare modeling session
Conduct modeling session
Write meeting minutes
Analyze and refine models
Present the results to stakeholders

Some steps in the process can be omitted and some may be added. This means that an organization may adopt more than one general modeling process. In any case they should be documented and made easily available to the organization in order to support the modeling experts and business stakeholders in their work and to standardize the process between specific projects. Such standardization will save time for modeling experts. It will also familiarize business stakeholders with the modeling process

and by that make them feel more secure in their participation throughout the various projects that they will be involved in. The introduction of newly employed modeling experts into the way of working of the organization will also be smoother if the process is documented and easily available.

An important decision to be made is which elicitation approach that is most appropriate for the organization. The authors of this paper recommend a participatory approach to EM as a general rule, based on previous research and a great deal of own experience. There are two main arguments for using the participatory approach, if possible [12]:

-    The quality of a model is enhanced if the models are created in collaboration between stakeholders, rather than resulting from a consultant's interpretation of interviews with domain experts.
-    The adoption of a participatory approach involves stakeholders in the decision making process, which facilitates the achievement of acceptance and commitment. This is particularly important if the modeling activity is focused on changing some aspect of the domain, such as its visions/strategies, business processes and information system support.

Although this is the recommended way of working, a less participatory approach such as interviewing and observation can be appropriate under specific circumstances, e.g. if the organizational culture does not allow for different views and opinions being expressed in a group setting.

4.3 Implementing the Method

As indicated, implementing a method in an organization is the most difficult and time-consuming part of the adoption process. There are many issues that need to be addressed in the process, e.g. how to acquire a method, whether or not to adapt the chosen method, acquiring competent modeling experts, acquiring modeling tools, starting to use EM. Evaluation and making adjustments to the implementation should not be neglected as well.

4.3.1   Acquiring a Method

An EM method consists of a modeling language and a modeling process (see Section 3.2). Some methods, like 4EM [4] come with a predefined modeling process but most methods do not. Therefore, the process of acquiring a method should also include selecting one or more ways of working, both in terms of the overall process of carrying out an EM project and in terms of elicitation approaches within a project (see Section 4.2.2). The chosen elicitation approaches will most certainly influence which competence that will be needed. More regarding EM competence can be found in Section 4.3.3 and in [12].

EM languages can be commercially available or they can be research based. When acquiring a modeling language it is important to consider its long-term sustainability, in addition to the fitness for purpose. Commercially available languages come at a price but on the other hand they may be more widely accepted and their long-term

development and support taken care of by the supplier. The ownership of the method is in such cases clear. Research based languages may very well be suited for their intended purpose(s) but the organization needs to ensure that they have been tested properly and that the method documentation is freely available.

4.3.2   Adapting the Method

Sometimes adaptation to the method needs to be made, particularly if the chosen EM method is intended to integrate with other methods, e.g. systems development methods. However, it is advisable only to make the really necessary adaptations in the beginning. After a few pilot projects (see Section 4.3.4) an evaluation can be carried out and further adaptations can then be introduced, if necessary. However, too many local adaptations to a method will make the method more difficult to maintain over time. It will also cause problems and additional costs in terms of adaptation of computer-based tools.

4.3.3   Acquiring In-house Modeling Competence

Most probably the organization will not have competent EM experts among its employees. This means that they will have to be hired. The different levels of EM competence is described in [11] should be considered here, i.e., ability to model, ability to facilitate modeling session, and ability to lead modeling projects. In [12] these competences were also related to the purposes of EM.

It should be noted here, that in order for an organization to be able to handle modeling projects on their own, the last two abilities are critical. Unfortunately it may be difficult to hire people who already have these abilities, because they take a long time to acquire. Hiring people on the highest level of competence may even be impossible. In those cases the organization may start out with a few simple projects with less experienced modeling experts that are hired from outside. The following quote from an interview with an experienced modeling expert illustrates the challenges:

  "We interviewed 73 or 74 potential facilitators. Out of these we chose 15 who we thought were at least reasonably good. Towards the end we had seven left. This is the real situation. We lost some on the first level. They didn't really have the ability to model. Some we lost on the second step. They didn't have the ability to facilitate modeling sessions. Then we lost some because ... well, all facilitators are exhibitionist prima donnas ... but some had too many co-operation problems."

An alternative to hiring modeling experts is to train employees who have shown an interest in EM and let them start working with some simple modeling projects, preferably under the supervision and mentorship of external experienced consultants. These projects should be evaluated from a competence perspective. Additional training activities can then be initiated based on the evaluation.

It is clear that training to become a skilled participatory EM method expert involves acquiring knowledge that is provided in the literature or by taking courses. However, most of the training must be focused on practice, in order to become more and more skilled. It can, however, be difficult to organize "learning by doing", with feedback loops in a systematic and practical way, for a large group of people. A complicating

factor here is that the person being trained needs to be subjected to a variety of situations, in order to be prepared for future assignments. In addition, the situation in real projects is often sensitive leaving no room for critical mistakes. This means that the number of skilled participatory modeling experts increases very slowly.

A practical way is to work together with more experienced facilitators. Novices should never facilitate alone, since the errors made during modeling will negatively influence the outcome of the process where modeling is used. With reference to the maturity levels of method experts, a common mistake that novices make is that they believe that just because they have learned to master a modeling language, they will be able to carry out a participatory modeling process.

Since modeling expertise takes a long time to build it is essential to allocate resources for competence assessment and development during a number of years. Also, planning for continuous exchange of experiences and mentoring between modeling experts will decrease the vulnerability of competence since it can help easing the dependence on individual modeling experts and allow individuals to develop from one competence level to the next.

4.3.4   Carrying out Pilot Projects

When an organization starts to carry out its own modeling projects some pilot projects should be initiated that are designed to test the modeling language, the modeling process, the modeling tools as well as the modeling competence. Evaluation criteria should be carefully defined. The series of pilot projects should be selected to reflect the different purposes for which the organization intends to use EM.

Most probably the organization will need to hire consultants to supervise the pilot projects and also to set up and carry out the evaluation.

4.3.5   Evaluation and Adjustment of the Method

In order to ensure that the chosen method will be useful over time, the organization also needs to document it and to organize its maintenance.

The maintenance of the method entails not only changing the documentation when the method evolves over time (and it probably will) but also setting up an evaluation process targeting modeling projects that are carried out in the organization. The criteria for selecting the modeling language and modeling process should be used in the evaluation, together with evaluation of the outcome of modeling projects.

Based on the results of the evaluation, different adjustments to the method may be needed. However, care should be taken so that these are not made hastily and frequently because it will cause unnecessary uncertainty and instability in the organization. It is advisable that any adjustments are based on at least 2-3 projects and that they are documented in detail and also communicated to the organization. The communication aspect is particularly important, since people tend to stick to old practices of modeling.

The evaluation can also show that the competence of method experts needs to be enhanced (see Section 4.3.3). Different training activities and exchange of experiences between method experts should then be initiated accordingly.

5   Organizational Structure to Support EM – The Modeling Department

In the previous sections we have discussed the activities that lead to adopting an EM approach in an organization. The result of these activities should be a pool of competent employees that can be used in EM projects, which in many cases may require creating a supporting organizational unit dedicated to modeling – a modeling department.

The following roles should be considered for inclusion in a modeling department:

- Facilitator – the modeling facilitator leads and advises the modeling participants during participatory modeling sessions.
- Method expert – organizations that have been more successful in using EM all had one or several persons who were very knowledgeable about the modeling method (or several methods) used in their organization. They were also very enthusiastic about the modeling way of working. Their enthusiasm also motivated their colleagues' support and engagement in modeling. We call them "method experts" while actually "method champions" would be more correct. These people have often been the first in their organizations who tried to "sell-in" the modeling way of working to their organization. Another responsibility of method experts is the development and maintenance of the modeling method used within the organization and if necessary integration with other methods and approaches.
- Tool expert – in order to use an EM method efficiently, a modeling tool is needed and, hence, the organization should also have in-house competence concerning the modeling tool(s) used. E.g., the different integration possibilities with other tools and configurable information systems, presentation possibilities on the web, collaboration support, tool versions and upgrades, etc. Depending on the actual methods and tools used and background of the people involved, the method and tool expertise can be combined and fulfilled by the same person(s).
- Model maintenance and presentation expert – modeling maintainers are required if the company wants to keep their business models up to date. In larger organizations where many different EM activities take place at the same time, modeling facilitators may not have the time needed to fine-tune the models, for instance, to the levels of presentation quality required for publishing the models on the intranet. Hence, the modeling department may include staff experienced in documenting models for various purposes – e.g. for presentation, for inclusion in reports, requirements specifications, etc.

The building of a modeling department depends on the organization's intentions regarding the long-term use of EM. If the organization wants to model without external consultants or keep models "alive" then it has to develop its own in-house EM competency. Such a task cannot be accomplished "overnight" – time is needed for the personnel to learn the EM method, to develop modeling skills, to develop in-house modeling guidelines and procedures, as well as to accumulate experience (see Section 4.3.3). An organization attempting to do this should also be aware that developing and sustaining a modeling department requires considerable resources.

6   Discussion and Concluding Remarks

The method adoption process can be seen as a process of knowledge transfer. Back-lund, Hallenborg and Hallgrimsson [13] discuss the process of adopting a method in an organization from this perspective (Figure 3).
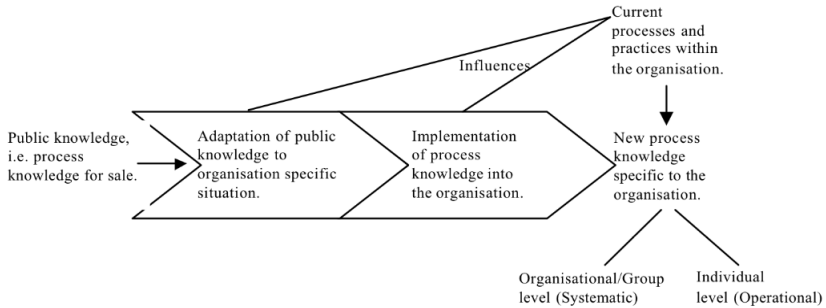

Fig. 2. The method adoption process, a knowledge transfer perspective [13]

A method encapsulates process knowledge, in the case of this paper the knowledge about how to carry out EM. In the process of adopting an EM method in an organiza-tion, this knowledge is transferred from the method constructor to the organization and is internalized by the employees of the organization. In the internalization process, the organization's current knowledge and practices meets the knowledge encapsulated in the new method. The current knowledge influences the adoption process and sometimes requires the new method to be adapted.

For a method to be truly adopted, all employees concerned should have embraced the new method and carry out their work according to it, a change that can take consi-derable time. This suggests that making a management decision about adopting a new method is just the beginning of the adoption process. In this paper we have discussed the adoption process from a fairly instrumental perspective, but the social mechan-isms and the culture of an organization will heavily influence the process. This aspect of the adoption process has not been addressed in this paper, but it will be included in future work.

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