

Experience Management: Models and Implementation

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Knowledge Management (KM) is becoming an important field of applications. Several subjects belonging to KM can also be cited. Among them experience management, related to only experience, is one of the most prosperous. Experience can be considered as human or machine experience; it is always a specific knowledge as opposite to general knowledge with a much broader scope; general knowledge is also processed according to different patterns. The paper describes some of the experience management models paying more attention to what we call the experience management model (EMM), relating all tasks involved in the particular experience we would like to model. EMM is more valuable for e-business and educational purposes (Intelligent Learning Systems).

Keywords Knowledge management; experience management; knowledge representation; artificial intelligence; multi-agent systems; international research project

1. General remarks

Experience Management (EM) is a particular type of Knowledge Management (KM) [1], restricted to only experience, and as we shall see, experience can be considered as human or machine experience. Experience is always a specific knowledge as opposite to general knowledge with a much broader scope; general knowledge is also processed according to different patterns.

Different models for dealing with Experience Management have been developed but we want to specifically consider what we call the experience management model (EMM). This one relates all tasks involved in the particular experience we would like to model. For that reason we think it is more valuable for educational purposes and mostly for the design and implementation of Intelligent Learning Systems.

The paper gives some details of those models but paying attention to EMM. Besides, it describes a particular example in the E-business field.

2. Models for Experience Management

Several models already developed could be basically modified and used for experience management, depending on the emphasis that different authors can do on particular aspects of KM although all of them attempt to capture, collect and share the institution knowledge by making use of the connectivity provided by web-based and intranet technologies. Models are usually powered by methods, dealing with specific details of the knowledge process and tools to ease the data processing aspects of the problem.

A) The Organizational Memory Model [2] is based on the following list of activities:

- Identify; determine the core competencies of the institution or company, sourcing strategies and different knowledge domains in use.
- Capture; formalization of the knowledge existing in the institution.
- Select; assess knowledge relevance, value and accuracy.
- Store; represent corporate memory in knowledge repository with various knowledge schema.
- Share; distribute knowledge automatically to users based on interest and work.

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-Apply; retrieve and use knowledge in making decisions, solving problems, automating or supporting work, job, aids and training. This activity points out a possible connection within the model between e-km and e-learning.

-Create; discover new knowledge through research, experimenting and creative thinking.

-Sell; develop and market new knowledge-based products and services.

A preliminary consideration of these activities shows the interactions and dependencies among those activities and, in consequence, the impossibility of executing them sequentially.

B)The Experience Factory [3] is motivated by the experimental conclusion that any successful business has to combine technical and managerial solutions allowing the fulfillment of several objectives such as: assist the developer in getting a set of products according to the customer needs, create competencies for future business, a well-defined set of processes to accomplish what needs to be accomplished, to control development and to improve over-all business and a closed-loop process that supports learning and feedback.

From a more practical point of view, an experience factory is an organization that supports project development by analyzing and synthesizing all kinds of experience, storing that experience and supplying it on demand. Experience in the development and execution of the project plans, is collected in an experience base consisting of informal or formal models. To enable best reuse these experiences are further packaged by means of generalization and formalization. That experience is offered to the project organization of the institution to improve its performance.

C)The Quality Improvement Paradigm is a model which has been used as stand-alone model or in combination with the experience factory model. It is based on the execution of a cyclic process integrated by the following steps:

-Characterize; initially the problem or process under development and its environment is characterized based on the available information. The characterization uses a certain amount of parameters, such as: application domain, susceptibility to changes, problem constraints, techniques, tools, existing software, budget, number of people, level of expertise, etc.

-Set goals; the measurable goals of the process or project has to be defined according to different viewpoints of the user, customer, manager, corporation, etc.

-Choose process; on the basis of the previous steps and the experience base, appropriate elements (process, methods, tools, ..) for the project implementation has to be chosen leading to the project plan.

-Execute; the plan is executed taking records of the different aspects of the execution.

-Analyze; collected data has to be carefully analyzed to assess current practices.

-Package; on the basis of the new experience the different models of the experience base could be generalized or tailored to a particular kind of situation to be reused in other projects.

D)Another model very well known is the Case-Based Reasoning Model [4], [5], coming from Artificial Intelligence and used for solving problems by direct reuse of previous experience. The main difference of this model in relationship to the previous ones is that it does not provide an organizational model for reuse but a cognitive model and a technical architecture. Previous experience appears in the form of cases, where a case is a mathematical pair constituted by a problem and its solution. Cases are stored in the case base.

This model is also based on the execution of a cycle:

1)-Retrieve; when the user gets a new problem enters a new query into the system by giving the problem description. This phase selects one or several cases from the case base considered useful for solving the new problem, according to the similarity of the new and that of retrieved cases under the assumption that similar cases will have similar solutions.

2)-Reuse; the reuse of the retrieved solution is used, often after adaptation. Adaptation methods are usually classified as transformational or generative methods; the first ones rely on a set of adaptation rules describing how differences in the current problem lead to required modifications in the solution. Generative adaptation methods require a complete generative problem solver able to solve problems based only on general knowledge.

3)-Revise; the scientific literature does not say so far very much about this phase dealing with the revision the solution obtained and its revision probably by a human domain expert.

4)-Retain; this is the typical learning case of a this model, by adding the revised case to the case base; that way the new problem solving experience will be available for reuse in the future. This phase has to be done very carefully because the continuous increase of the case base results in a decreasing retrieval efficiency.

3. The Experience Management Model (EMM)

The Experience Management Model relates the different tasks involved in experience management. It is composed by a knowledge kernel and two shells around it. The knowledge kernel contains not only the experience base but also the use-related knowledge including the vocabulary. The next shell around the kernel consists of the problem solving cycle including: the problem acquisition, experience evaluation and retrieval, experience adaptation, and experience presentation. All of them are supported by experience reuse with the help of IT.

The outer shell of the EMM is the development and maintenance methodology. The knowledge kernel and the problem solving cycle are the subject of the development and maintenance methodology. The diverse processes that occur in this shell address the acquisition and maintenance of the knowledge in the kernel as well as the technical, organizational and also managerial aspects of the problem solving cycle and its implementation. The processes occurring in the development and maintenance methodology are not easily automated by using IT technology, although some aspects of them can be partially supported by different kinds of tools. Those processes are also integrating a cycle which must be started each time a kind of maintenance is required. The cycle differs from the problem solving cycle in different features; the former is executed as seldom as possible but the latter is executed as often as possible.

1)The problem solving cycle supports complex problem solving by providing appropriate experience. It contains the following elements:

- a) Complex problem identification; it assists in identifying a problem for which assistance is required.
- b) Problem acquisition module; with it the problem is elaborated and described.
- c) Experience evaluation and retrieval; the available experience in the Experience Base is evaluated and retrieved with respect to whether it is appropriate to support solving the particular problem.
- d) Experience adaptation; the retrieved experience is further tailored to suit the current problem.
- e) Presentation module; the fitted experience is presented to the user during further problem solving.

The cycle must be initiated several times addressing a different subproblem that occurs during problem solving.

2)The Development and Maintenance Methodology cycle includes several processes in order to acquire and update the required experience knowledge and to customize the problem solving cycle, and requires modeling and maintenance of the experience kernel.

The main aspects to be covered by this cycle are the following:

- a) The process of project management, including cost and resource assessment, time schedules, project plans, quality control procedures, etc.
- b) The specification of the different kinds of products or deliverables that must be produced.
- c) The process of product development and maintenance, including all technical tasks that are involved in the development and maintenance of the software .
- d) The analysis and organization of the environment in which the system should be introduced.

The referred processes can be classified as:

-Technical processes; describe the creation or modification of the experience management software components or the represented knowledge.

-Organizational processes; address those parts of the user organization's business process in which the software system will be embedded.

-Managerial processes; provide an environment and services for the development of software that meet the product requirements and project goals, such as project planning, monitoring and quality assurance.

All the processes are integrated in the following cycle:

- a) Vocabulary Development and Maintenance; is a very crucial task since the knowledge containers rely on the vocabulary.
- b) Development and Maintenance of Reuse-Related Knowledge; involves modeling knowledge for assessing the relevance of an experience item for the actual problem. It can be made based on the similarity between the current problem and the problem in which a particular experience item was collected. This process also includes modeling adaptation knowledge represented in the form of rules, operators or constraints.
- c) Experience Base Development and Maintenance; initially performed by transforming and integrating existing experience sources like Data Bases, documents or Web resources. If no such sources exist a manual experience acquisition process must be established and integrated into the existing problem solving process.

4. Example: Experience Management for E-Business

A concrete example related to the Experience Management Model is going to be analysed. Here we will include only the Knowledge (Experience) the application has to deal with. Design and implementation details cannot be included due to space limitations.

In this type of application different kinds of knowledge play an important role:

-knowledge about products: product properties, technical specifications, application areas, product structure, compatibility with other products, pricing, experience about products behavior and faults,..

-knowledge about clients: requirements, preferences, wishes, shopping type, product language, cultural affiliation,..

-strategic knowledge: about recommendation, communication, negotiation, sales,..

One important point to be considered is the lack of product knowledge at the customer side and the lack of customer knowledge at the vendor site. In the traditional sales scenario the knowledge gap is bridged by the human sales agent by using his strategic knowledge to mediate between the customer and the vendor. In the on-line sales process the system, virtual sales agent, must also bridge the knowledge gap through appropriate communication. Therefore, the system has to include that strategic information for the mediation.

The conceptual model of the application can be synthesized as follows. Four consecutive phases can be identified in the business process of General Electronic Commerce:

1)Pre-sales, including:

-Supplier search; the potential client investigates which supplier is able to solve his problem or satisfy his needs. However, products from different suppliers could be combined to satisfy the customer's need. The selection of supplier is based on the type of product rather than on its particular features.

-Product search; now a detailed product selection must be performed. The selection is based on the detailed identification of wishes, requirements, and preferences of the customer. For fixed, unchangeable products this is a pure selection process; for more complex products able to be configured, a buyer-directed customization is required.

The virtual sales assistant has to guide the customer during product (or supplier) search. The customer has a set of wishes concerning the product, but the wishes can be: vague, uncertain, expressed incorrectly, contradictory to other wishes, and even impossible of being satisfied.

One possible way of identifying some features of a concrete wish could be by establishing its: importance, precision and certainty, besides the concrete nature of the wish. Also, when a set of wishes is contemplated some other features have to be included such as: redundancy and consistency of one wish in relationship to the full set.

Now products have to be considered. They can be classified according to many different criteria; one important criterium for our purpose can be their ability to be customized. According to this we have:

- a) fixed products; they cannot be modified;
- b) parametrizable products; they can be discretely modified with also discrete (the number of processors of a computer)or continuum values (like the length of a cable);

- c) configurable products; they are created by combining several components (fixed or parametrizable) in a certain way. The determination of the overall product is a configuration process;
- d) individually designed products; they are created as the result of a design process, such as architectural objects or software.

Experience should help to identify products that are at least acceptable. The experience required for this and the way it can be represented depends strongly on the kind of products and on the size of the knowledge gap. The size of the knowledge gap determines the content of the experience while the complexity of the products determines the representation.

In the case of small knowledge gaps, that is to say, when the customer possesses the relevant information for deciding whether a product is appropriate or not. This is often the case in B2B scenarios in which the seller offers a limited number of standard products that are either known by the customer through common sense, or based on a clearly defined terminology in the expert domain. In the case of large knowledge gaps we have to deal with two different languages: the language of the customer describing product functions and the language of the seller describing product features; for matching those languages experience is required that describes that a certain product can be used to realize a certain function. The experience characterization part must describe possible product functions and the lesson part must specify a particular product or the features of a product that is suitable.

2) Negotiation; buyer and seller start negotiations to come to an agreement about: the price and way of payment, details of delivery, certain regulations about cost and delivery.

3) Sales; it is the main transaction including: product order, payment and delivery to the customer.

4) After-sales; if the customer needs some kind of support related to the product, this phase starts the operation. Two different after-sales activities can be distinguished:

- a) Service; it aims at increasing the utility of the product for the customer. This can be achieved through a troubleshooting service related to product maintenance, usage of the product or product updates.
- b) Community; community support means to enable different customers to exchange experience about products or vendors. This can help new customers to exchange experience about products or vendors. This can help new customers during the buying decision; it also provides useful information for the vendor about customer requirements, desired product improvements and acceptance of the products in the market.

5. Conclusions

So far, several conclusions can be drawn:

-Experience management is an important constituent of Knowledge Management because it considers specific knowledge related to human expertise.

-Although the consideration of EM for E.business applications is lengthy and cumbersome, it provides a new horizon for the efficiency of those applications.

References

- [1] F. de Arriaga, E-Knowledge Management, E-Learning and E-Commerce: An Evaluation of their Situation and Tendencies, International Computer Science Institute, University of California (Berkeley), 2004.
- [2] H. Werthner, M. Bichler, (ed.), Readings in E-Commerce, Springer-Verlag, Berlin, 2001
- [3] A. Tiwana, Knowledge Management Toolkit: Practical Techniques for Building a Knowledge Management System, CRC Press, 2002.
- [4] E. Wenger et al., Harvard Business Review on Organizational Learning, Harvard Business School Press, 2001.
- [5] S. Tannenbaum, G. Alliger, Knowledge Management Clarifying the Key Issues, IHRIM, 2000.