IDEA GROUP PUBLISHING

701 E. Chocolate Avenue, Suite 200, Hershey PA 17033, USA
Tel: 717/533-8845; Fax 717/533-8661; URL-http://www.idea-group.com

ITP4800

Project-MEMO – Integrated Process Based Enterprise-Resource and Project Planning

Bardo Fraunholz and Hanno Schauer
Institute for IS Research, University of Koblenz
Universitätsstraße 1, 56070 Koblenz, Germany
Tel. +49 261-287 2536 Tel. +49 261-287 2533
Fax +49 261-287 100 2536 Fax +49 261-287 2521
bardo.fraunholz@uni-koblenz.de hanno.schauer@uni-koblenz.de

ABSTRACT

For many businesses the common administration of projects in addition to their daily business constitutes a great challenge – a major obstacle seems to be that conventional project management tools and languages do not aim at an integration with standard ERP systems or frequently used business planning languages. This article presents Project-MEMO, a new modeling approach for an integrated planning, implementation and controlling of projects in businesses. The foundation of Project-MEMO is the augmentation of process description languages to enable an integrated modeling of projects. Project-MEMO unites languages to compile a multi-perspective image of a company - such as processes, the organizational structure of business units and projects, business goals, as well as resources. This article's aim is the presentation of the Project-MEMO kernel: languages describing the dynamic and static structure, and the unifying language architecture. On top of the integrated administration of projects with standard enterprise planning, this article explores additional benefits derived for Multi-Project Management and Knowledge Management.

1. INTRODUCTION

There are apparent similarities between projects and many of the business processes in project driven businesses. To be more precise, projects consist of business processes such as an initial customer inquiry or the production process on a building site; therefore it seems appropriate to be looking for approaches that can be used in both domains. Literature on business process (re-) engineering focuses on organizing business processes and – from an information systems perspective – on designing/implementing IT support (Scheer 1994).

To be able to make use of planning knowledge for project management it is necessary to understand resources, processes and the underlying organizational structure crucial for a business which is directly or indirectly related to projects. In order to realize this understanding we had the chance to identify core structures and business processes within the building industry and made them explicit by using the Process Modeling Language (PML) of the Multi-perspective Enterprise Modeling method (MEMO) (Frank 1999, Frank 2002). Our languages augment the MEMO-approach. MEMO embraces languages to model an enterprise from various perspectives along with a guiding process model. The purpose of MEMO is to support the development of domain-specific high quality enterprise information systems. Project-MEMO, the approach presented in this article, serves as a tool for the administration of organizations or more specifically projects.

In addition to those business processes that can also be described as projects, there are many which are not directly related to the revenue-creating core competencies businesses perform. Yet, these processes represent necessary issues that must be accounted for. Ideally we are looking at an integrated system allowing us to use traditional project management skills – and project management software – but at the same time will support us in organizing and keeping track of the other processes which are essential for the business.

This triggered an idea to expand and adapt conventional project management tools or ERP systems respectively to meet the demands and specific requirements of project driven enterprises - further enhancing them by adding a knowledge component. The aim is to provide the business with accurate, up to the minute knowledge of projects and with the feature of drafting a project plan for a future by facilitating experience of previous projects.

2. PREREQUISITES OF PROCESS BASED PROJECT PLANNING

As seen above the practical similarities between processes and projects are far-reaching. However there are significant differences in the definitions and concepts. Therefore it is necessary to explore the divergence which can not be covered by conventional process modeling concepts. We find that processes are aiming at describing status and therefore are less dynamic, but more often reusable as project management. We need to introduce dynamic concepts that will allow for versioning, the support task and phase models, for the integration of different planning models and project specific concepts such as milestones.

Rising from the multi-perspective nature of MEMO we are aiming at a language that provides enhanced transparency. The language must be easy to use at all levels of the project management process and provide intelligibility for all participants and stakeholders involved in the project at all times. Therefore, the model should provide for documentation and support formal communication. The integrity of the model will also provide for the management of virtual projects or simply cooperative work. The notation of the language should be intuitive for all parties involved and must be error-resistant in use with the added benefit of explicit consideration of project specialized or related knowledge.

The main advantage of the Project-MEMO modeling language is the integration and coordination of projects with conventional project management and enterprise models. MEMO provides for integration and compatibility of the relevant modeling languages thus making the project an integrated part of the enterprise and its strategy. The advantage of this is the joint consideration of all aspects of the business with an easily legible notation, bringing together all stakeholders of a project participates in an appropriate manner. At the last stage, after a few projects the concept will provide for Knowledge Centered Project Management and Multi-Project-Management. This approach offers specialized project knowledge, rich documentation as well as reuse of project related knowledge and in particular project plans, as well as the transfer of accrued "project-knowledge" into the ongoing concern of the enterprise.

Such a design is complex and necessitates different levels of abstraction. Examples for such abstractions are project type, project instance, project plan and versioning. The language must be downward compatible with conventional project management languages and of visualization. Naturally the Project-MEMO modeling language will be scalable for all potential project sizes and pertinent communication and coordination requirements arising within projects. At the last instance there will be an integrated tool assisting the entire modeling and management process within enterprises.

3. DEFINITION OF AN INTEGRATED PROJECT-MEMO MODELING LANGUAGE

Project planning as well as the Project-MEMO approach embraces many planning activities. In the following, we focus on the planning of the static and the process structure of projects as well as on the underlying language architecture. Further areas, covered by Project-MEMO, such as resource planning, skill management, risk management and controlling, goal alignment or change management will be discussed at later stage.

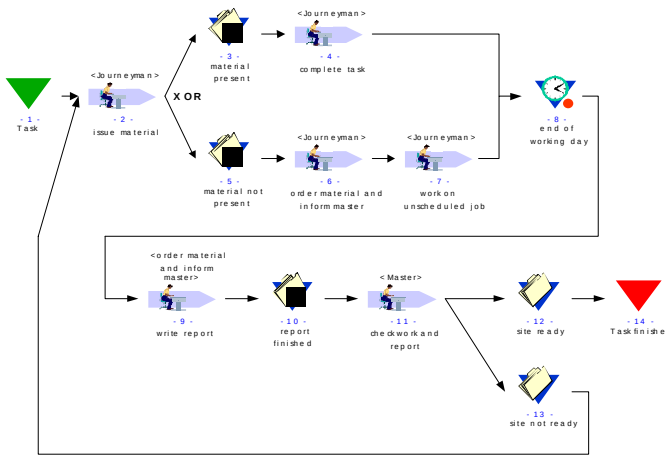
3.1 The process structure

The process structure provides an image of essential processes involved in running a business. Such processes are normally triggered by customers and prod certain actions. Ideally an enterprise has a model of all its processes and therefore is able to build on such a model for the integration of project management into the processes already existing within the enterprise. However, our work with businesses in the building industry has shown that this is rarely the case and if any, only some few models of processes in redevelopment or those central to the business have been drafted (Fraunholz 2001).

In order for an integrated project modeling concept to be beneficial to the enterprise, in the long term it is necessary to fully understand the processes within the organization and to be able to pinpoint exactly where projects have an impact. These interfaces must be clearly identified and defined. The aim of integrating the modeling of projects with those of processes is to make the way a project impacts the business more transparent for the business, the stakeholders and other participants. This can be assisted further by the introduction of an easy to understand notation as shown in Figure 1.

Often we find that significant elements within projects are already covered by the standard processes already in place in an enterprise. Such processes do not have to be reinvented within the project and should ideally be integrated in the project plan in continuance. The structure will allow for such processes to be labeled as project relevant and at the same time maintain the conventional aim. Any necessary alteration will be documented and modeled to be in line with the project or the conform requirements.

Figure 1: Graphical Representation of an on Site Production Process



In order to derive an evocative model we need to make a clear distinction between processes that are solely project tasks, the normal business processes and those that are an "intersection" of both, the particular project and conventional business process. The model provides for different views showing the whole of the processes including those tasks related to projects at the time, showing an excerpt relating to those exclusively project relevant or those solely related to the day to day running of the business, excluding those added only necessary for the project.

Supplementary to the dynamic enhancement of process models we need to provide qualities that are sufficient for more specific planning features of projects such as the precise staffing and financial status. The introduction of concepts for activity planning and work schedules is not trivial because it necessitates the introduction of a comprehensive concept for scheduling. Also we demand that our new concept of process based project planning facilitates the exigency for MEMOs innate multi-perspective integration of aspects such as strategy, structure and process.

There is a further distinction between processes and projects. While processes are typically modeled on two levels of abstraction, type level ("order processing") and instance level (processing of order X, Y or Z), this is certainly not clear for projects which are deemed to be unique. Currently we favor to model tasks and phase models only on the type level in order to avoid conceptual overhead, thus allowing a higher degree of usability and flexibility, sacrificing the one-to-one relation of structural similar real world tasks to their explicit and unambiguous archetype.

The descriptive nature of processes can not be sufficient to model projects. It is a useful description of the tasks necessary for the project thus describing work packages but we need additional concepts that facilitate the scheduling of tasks which is crucial for the planning and controlling of projects. In addition to that we need to introduce concepts that are not covered by the process models – such as resources and consequentially describe the organizational structure of an enterprise – which is described in the following – and the way this is inclined by projects.

3.2 The organizational structure

The organizational structure of businesses as well as of projects primarily expresses information about the arrangement and forms of leadership, such as disciplinary authority, technical assignment, organizational hierarchy, proprietary rights or job descriptions. Modern organizations are usually not planned and build up in single hierarchies. In recent years, with the increase of information technology and the partially decrease of the number of organizational hierarchy levels new forms of communication and collaboration emerged. These expanded the number of concepts to describe the static structure, such as virtual communities or inter-organizational value chains. Today, a multitude of organizational forms are simultaneously used in enterprises, some of the most common examples are matrix organization, hypertext organization (Nonaka, Takeuchi 1995), or project based organizations. In the context of the previously mentioned organizational forms even new notation standards have been established. A diversity of hybrid organizational forms is applied in various ways not only within a company, but also spanning third-party organizations and further stake holders – typical examples are projects and virtual enterprises. To our surprise describing the organizational structure became more challenging than it initially appeared.

In order to be able to meaningfully and handily model organizational and project structures, we make use of the distinction between inter-organizational and intra-organizational structure as well as primary and secondary organization. Formal inter-organizational structures refer to interlacing of capital interests or contracts between companies as well as the resulting disciplinary and technical authority. The primary organization expresses timely stable organizational units within a company. The secondary organization covers discontinuous organizational shapes like projects or intermittent commissions, inter-organizational groups and loosely organized communities like expert communities.

The interrelation between primary and secondary organizational units is modeled by conceptual delegation: “primary units” or even entire organizations can fill a (indivisible) role in units of the secondary organization. Delegation couples the lifecycles of units of primary and secondary organization. Additionally, with this concepts collaboration and communication of participating groups can be expressed by simply drawing communication associations or, more advanced, by defining interest-groups as a form of secondary organization. As a consequence, also (inter-organizational) projects or even virtual organizations can be described and (structurally) managed.

3.3 The Language Architecture

The language architecture for MEMO and the presented approach are defined by a meta-model approach. There are different ways to define a language; a meta-language approach describes the languages as well as the concepts defined by these languages within the same paradigm. As soon as the language definition is of importance for users of the language, a meta-model approach is convenient and advantageous to work with.

The Project-MEMO language architecture consists of three levels of abstraction: the language, the type, and the instance level. The language concepts (e. g. “process”) are defined within the language level. In general the language definitions stay unchanged. If necessary, for example in the case of an initial system installation, it is recommended to carry out changes carefully and only by modeling experts. On the type level, classes of real world objects (e. g. the process type “order processing”) are described by means of the language level concepts. The instance level represents the real world objects (e. g. processing of “order #12345”). Organizational units as well as projects (refer also to 3.1) form exceptions to the hierarchy of abstractions, because of its uniqueness each type (e. g. “marketing department”) is to be instantiated precisely once. (Refer also to *Singleton Pattern* in (Gamma et al. 1995).

The language architecture is designed to foster IS-support of the models and therefore to assist the administration of projects. Typically separately modeled and analyzed views at an organization, process, or project are stored and administrated within a common and combining object model on each level of abstraction. The object model allows for the generation of views. On the one hand, this facilitates to offer different views utilizing different notations on one or more of these data structures (models). Also yet undefined views and notations, e. g. for critical path analysis or Gantt diagrams, can easily be generated. On the other hand, the design of the architecture fosters accuracy of the models and helps to avoid redundancies. Furthermore, the different levels of abstraction allow for the reuse of planning knowledge and make the relationship between different instances explicit.

Figure 2: Excerpt of the Meta-Model of the Organizational Structure

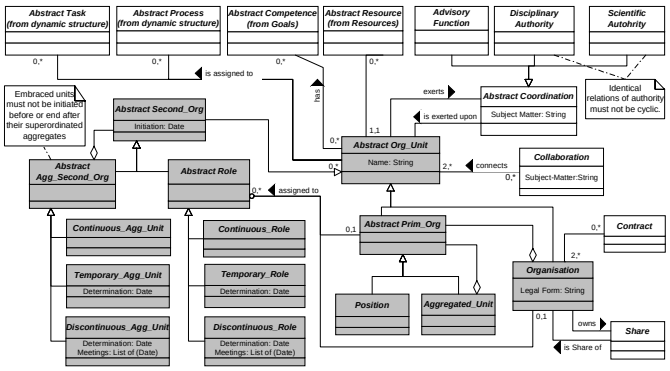
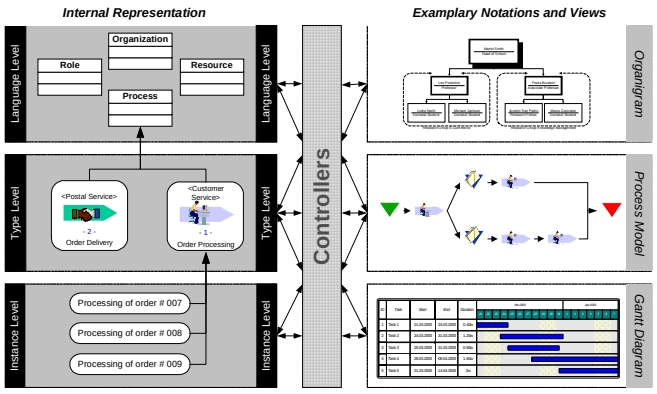


Figure 3: Depiction of the Project-MEMO Language Architecture



4. ADDED BENEFITS

The Project-MEMO languages and the according language architecture allow for an ERP-like integrated planning of an enterprise and its projects on a single- and multi-organizational level. This embraces the planning, administration and controlling of projects and the hosting enterprises. This integrated management additionally benefits the company since it fosters multi-project management and offers support for knowledge management.

4.1 Multi-Project Management

The claim for comprehensive project management often embraces the call for Multi-Project Management (MPM) (Fraunholz 2001). Beside the planning and supervision of single projects, MPM aims at the coordination and integration of a larger number of projects competing on the same resources, being similar or synergetic. Projects commonly managed within a MPM endeavor are administrated within a MPM steering committee, which – just like any other form of (secondary) organization – can be managed by the means of Project-MEMO. But, the language concepts of Project-MEMO offer additional assistance for the interrelation of projects and their concerted administration. Because the definition of (shared) languages and notation are open to look at and to be customized, the resulting concepts have comparatively more (extensional) semantics and are more likely to suit the user’s needs. As a consequence, Project-MEMO is likely to foster a common understanding and terminology better than languages of current project management systems and is also likely to enhance collaboration.

The Project-MEMO languages allow the definition of company specific project standards, such as pre-set process models or milestone activities. Project-MEMO also encourages the re-use of planning knowledge generated in earlier projects. The fact that on each level of abstraction there is only one common object model enables and enforces the joint administration of all objects shared between projects – especially commonly used processes or resources.

4.2 Knowledge Management

Knowledge management within projects and organizations carrying out projects has to meet different challenges. Among the most virulent difficulties are delivering useful knowledge into projects, optimizing communication and collaboration between participants or different projects, as well as preserving knowledge developed within projects and disseminating it within an organization.

Project-MEMO supports the development and maintenance of Project Memories (Frank et al. 2001) in various ways. With its ability to store and administer knowledge about a project’s static and dynamic structure, Project-MEMO supports project co-ordination and project communication of and in between running projects. According models give participants access to administrative knowledge about a project,

such as the project's structure, the organizational environment, or project standards, which is of special importance for distributed or multi-organizational endeavors. Also, knowledge related to the project's subject can be linked to the project description.

Knowledge management ventures themselves are often planned by and implemented as a shape of secondary organization, such as knowledge projects, or knowledge management initiatives (Schauer 2001), communication channels, or knowledge communities (Wenger 1999). A more complex, but less hierarchic organizational structure is often the outcome of knowledge management. In this respect, the abilities for MPM and the management of units of secondary organization make Project-MEMO also interesting to use within knowledge management endeavors.

5. CONCLUSION AND FUTURE WORK

Project-MEMO has enabled us to integrate two fundamental steering procedures – the project management and the administration of the core business. Project-MEMO also offers benefits for the integration of collaborating companies by providing for a common conceptual "backbone". This is achieved by the introduction of a common object model, describing all aspects of business and projects. Such an integrated model presents the base for inter-business communication and reduces misperceptions by its common object base. The Project-MEMO language structure is represented by state-of-the-art object orientated concepts, utilizing three levels of abstraction; therefore avoiding redundancies and fostering maintenance of the languages as well as the models defined within.

Through the generation of individual views it is possible for a user to find a domain specific representation. This approach is very user friendly because it supplies each user with a tailor made excerpt of the business or project, thus providing fast and concise access to knowledge. We belief, that graphical representation allows for users of different realms and backgrounds to understand the models. The notations are tailor made to suit each user and to provide the best possible and concise representation. The notations pre-defined in Project-MEMO reconstruct scientific languages of the business and project management field. Therefore they serve as common languages and basis for joint communication between stakeholders and participants

For the business our approach has the added benefit of providing transparency and once business processes and the organization have been identified, made explicit and modeled there is very little effort involved to alter, adopt and reuse those models in other business contexts. Therefore the planning of projects or the integration of organizational units in collaboration is easily and efficiently achieved without the usual expense of involving external project managers and lengthy planning and reorganization of the business. This is especially beneficial for MPM where certain organizational units and processes need to be identified, their workload assessed and subsequently adapted to suit the need.

Finally, Project-MEMO offers benefits and facilitates knowledge management for projects and knowledge management implemented in the form of projects or so called knowledge management initiatives.

Our next endeavor will be the development of a tool-collection for integrated project management and ERP. As prescribed in the Model-View-Controller pattern (Gamma et al 1995) we aim at a system for the administration of common object models, several editors (view) and controllers facilitating different views on the object model. In addition to this we continue to work on the refinement of the meta-models and notations of Project-MEMO.

REFERENCES

Frank, U (2000): *Multi-Perspective Enterprise Models as a Conceptual Foundation for Knowledge Management*. In: Proceedings of the Hawaii International Conference on System Sciences (HICSS-33), Honolulu.

Frank, U (2002): *Multi-Perspective Enterprise Modeling (MEMO) – Conceptual Framework and Modeling Languages*. In: Proceedings of the Hawaii International Conference on System Sciences (HICSS-35), Honolulu.

Frank, U; Fraunholz, B; Schauer, H (2001): *A Multi Layer Architecture for Integrated Project Memory and Management Systems*. In: Khoshrow-Pour, Mehdi (Ed.): Managing Information Technology in a Global Economy: Proceedings of the 2001 Information Resources Management Association International Conference, Toronto, Ontario Canada. Hershey; London; Melbourne; Singapore: Idea Group Publishing, S. 336-340.

Fraunholz, B. (2001) *Project Management in the German Trade Sector - A (preliminary) Framework for the introduction of Computer Assisted Management of Projects in Small and Medium Sized Enterprises*. Proceedings of the Australasian Conference on Information Systems, Coffs Harbour, NSW 2001, vol. 1, pp. 237.

Gamma, E; Helm, R; Johnson, R; Vlissides, J (1995): *Design Patterns: Elements of Reusable Object-Oriented Software*. Reading, Mass.: Addison-Wesley.

Nonaka, I; Takeuchi, H (1995): *The Knowledge-creating Company*. Oxford; New York: Oxford University Press.

Schauer, H (2001): *A Process Model to Introduce and Continuously Foster Holistic Knowledge Management*. In: Smari, Waleed W.; Melab, Nordine; Yetongnon, Kokou (Ed.): Proceedings of the International Symposium on Information Systems and Engineering ISE'2001. Las Vegas: CSREA Press, S. 164-171.

Scheer, A.-W. (1994) *Wirtschaftsinformatik. Referenzmodelle für industrielle Geschäftsprozesse*. 4th ed., Berlin, Springer.

Wenger, E (1999): *Communities of Practice – Learning, Meaning, and Identity*. Cambridge: Cambridge University Press.