

Quality Management Modeling of Business Processes in IS Projects

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Abstract. Years of evolution in the field of information systems, business processes and universal modeling notations have resulted in the creation of modern modeling languages, such as BPMN or UML. Founded languages concentrate on processes and activity flow without taking into account important management categories like quality or control. These aspects permit the research thesis that there is a room for further modeling improvement. The article concentrates on analyzing the role of quality management modeling for business and project processes. It begins by introducing the current state of modeling languages. It is a starting point for the presentation of elaborated quality-oriented notation for the business and project processes. The concept discussed in the second section is presented as a separate diagram type. A sample model is also included showing notation capabilities and its practical usability. The third part of the article presents verification of proposed quality management modeling approach of processes in IS projects. The article concludes with a summary.

Keywords: quality management, business process modeling, project management, modeling notation

1 Introduction

As opposed to the analysis and design of information systems dominated by UML language, there can be no single denoted key notation in the discipline of process modeling. In many situations, organizations leave methodological and notational aspects to the contractor, even though some methodologies used by companies pre-date the notion of process modeling [8] and most approaches employed are niche in character.

A strong impulse in the development of modeling approaches occurred in the 1990s. This was a natural consequence of organizations' reorienting in the direction of process management and solutions were elaborated for use in business process management. An exception, however, was UML (Unified Modeling Language) as a standard for general use. Modeling approaches connected with IDEF (Integration Definition Methods) [9] were widely practiced, with the most important being IDEF3. Visual modeling approaches like ARIS (Architecture of Integrated Information

Systems), with its characteristic diagram eEPEC, began to have more impact. This popularity was connected with ARIS integration on the part of the company SAP into the SAP R/3 ERP system. Another popular modeling system is BPMS (Business Process Management System) implemented by BOC into ADONIS business process management software.

The first efforts to unify visual modeling techniques were conducted by the OMG (*Object Management Group*) consortium. Research and design was concentrated on development of UML in the field of business process modeling [1] [4]. With this scope in mind, suitable standard extensions were prepared, the most important of which are Eriksson-Penker Business Extensions [3] and Rational UML Profile for Business Modeling [3]. Another modern approach considered as a candidate for wide adoption is BPMN (*Business Process Modeling Notation*) [5], which, unlike UML, has a very specialized character dedicated to business process modeling.

All the above modeling notations concentrate on modeling processes as a flow of activities with distinguishing decision-making aspects. Some integrate notation, allowing modeling document flow (UML and BPMS), workflow (BPMS) and risk management (UML) but they still do not take into account important management categories distinguished by PMI (Project Management Institute) like: quality, control or communication [2]. These are all especially important in processes connected with project management. Integration of risk management into notation in BPMS shows that organizations responsible for business process modeling are aware of current notation restrictions. Nevertheless, new notation can only be exclusively acknowledged as the initial one on a general stage [9]. Risk and quality are suggested as key aspects of project management [9]. Risk management modeling has been presented in separate articles from the perspective of e-learning projects [10] as a general modeling concept in the form of an extension for modern notations like BPMN and BPMS [10]. According to The Bull Survey, one of the major causes of project failure is lack of or poor quality control [6]. In 35% of projects analyzed, weak, improper quality management was identified as a failure criterion. Only bad team communication and lack of planning were rated higher. Even though quality management is treated as integral part of project management it is omitted in modeling of process. Lack of integrating complex specifications of quality management for activities often causes a cursory quality management in projects. This indicates the importance of proper, systematic and unified quality management of business and project processes with appropriate support from modeling notation in designing process specifications. None of the modeling approaches presented here contains diagrams for managing quality of processes. It is an important factor in the lack of integration of quality management in models for business and project processes, not to mention the quality-oriented modeling of processes.

2 Quality management modeling of business process approach in IS projects

Using the quality-oriented modeling approach to manage IS projects, with a strong emphasis on integrating it with business process models, should be an important element in eliminating project failures due to no or poor quality control. Quality management is meant accordingly to PMI organization as degree, in which a set of inherent characteristics provides the imposed requirements. Lack of any notation for complex, universal quality management modeling with a close connection to business models or project processes demanded the elaboration of author notation from scratch. Moreover in future it could be implemented as an additional diagram type in popular modeling approaches like UML or BPML and integrated with diagrams like activities diagram (UML) and business process diagram (BPML).

As a key element of quality management modeling, quality management diagrams were assumed to refer models of processes. To achieve such a result dedicated stereotypes for business processes diagrams were elaborated (table 1).

Table 1. Notation stereotypes used for identifying management categories

Symbol	Description
	quality management
	risk management
	communication management
	cost management
	time management
	control management
	resource management
	document flow management

As solution to integrate quality management modeling with processes, stereotypes for activities were used. Such integration of quality management is possible for the BPMS by assigning the correct symbols to activity objects. In this way, the correctly ascribed icons fulfill the role of stereotypes for activity objects thus extending their meaning. Such an approach permitted both the integration of quality management modeling with processes models and quick reference in locating detailed quality control diagrams connected with particular processes. Fig. 1 presents such integration for the process requirement analysis of e-learning course development which is the starting process for e-learning course development and implementation project. Integration of quality management stereotypes also allows for verification whether the number of activities exists that contain actions for ensuring the requirements of

intermediate components and the final product. In e-learning projects such elements are: course outline, e-learning course script, e-learning course instructional design, multimedia objects, authoring tool components and, as a final product, e-learning course implementation packages. The elaborated modeling approach thus supports quality-oriented modeling of business and project processes.

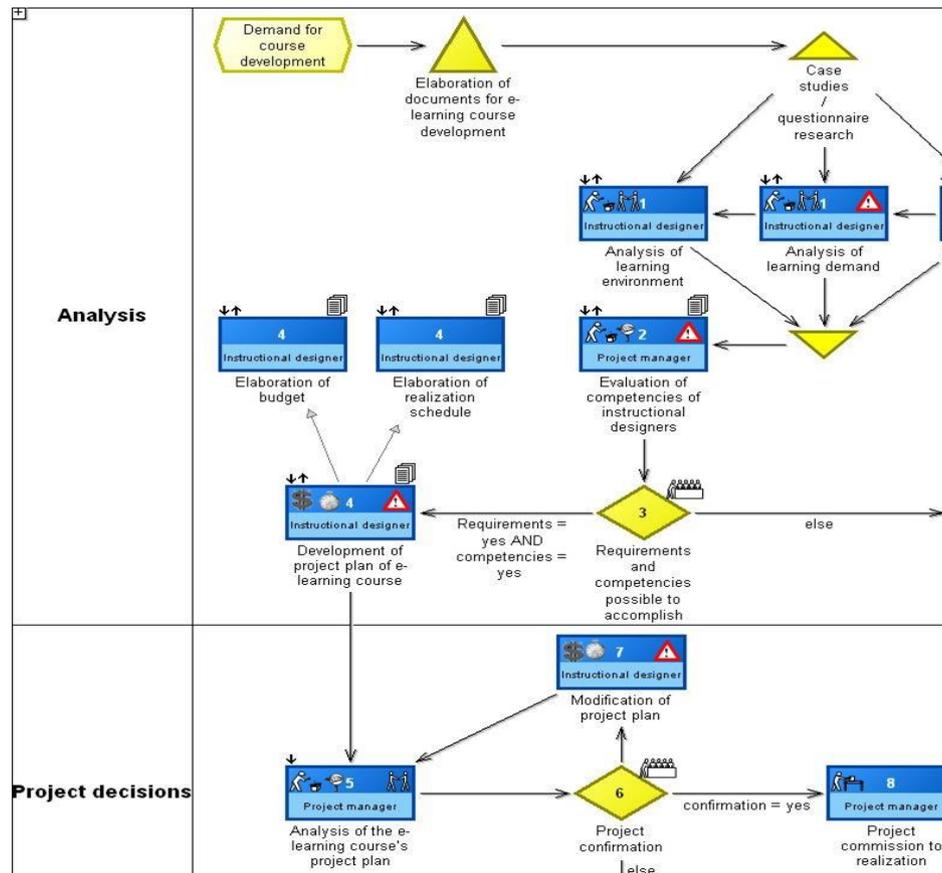


Fig. 1. Process model with integrated quality management – requirements analysis of e-learning course development

The modeling approach used for the integration of quality management with process models was also used for other important project management categories such as risk, control, costs, time, resources, document flow and communication. The notation was developed based on the present author's experience. As a new concept it required appropriate verification that is presented in the third part of the article. Quality management modeling is based on a dedicated diagram consisting of the visual notation elements presented in table 2.

Table 2. Notation for quality management modeling of business processes

Symbol	Name	Description
	Activity	Activity connected with quality management and related by name to the business or project process model.
	Coordinator	Person responsible for actions of quality management within the framework of the activity.
	Participant	Role responsible for supporting actions of quality management.
	Action	Action undertaken for quality management of the activity.
	Method	Quality management method applied during activity implementation.
	Result	An element, usually a document, which is the result of quality management for the action.
	Manages	Connector that assigns the coordinator to the activity for which tasks related to quality management are executed.
	Participates	Connector that indicates the roles involved in the actions of quality management for the activity.
	Process route	Path of quality management realization for the process.

The aim of the modeling notation showed in table 2 is not only to support specifying quality management for business processes. It concentrates also on stimulating quality management thinking about processes. Thus starting modeling element in notation is activity that forces analysis what operations should have quality management and what activities connected with quality management are missing in processes. Later with the use of notation elements like coordinator and participants proper roles for running quality actions should be specified. Finally formalization has to include methods of quality management execution with distinguishing results. Thus the approach assumes diagram development from bottom (activities and coordinators) to up (methods and results).

Elaborated modeling notation was used during the development of a complex, integrated project management model for the development and implementation of e-learning projects. A sample quality management diagram elaborated with the use of the notation developed for the process of the elaboration of e-learning course script is presented in fig. 2. Quality management is mainly connected with activities related to assessment, training, consultation and verification. Thus, quality management in the process of the elaboration of an e-learning course script refers to activities such as course outline evaluation in accordance with requirement analysis or consultation of methodology for preparing an e-learning course script. The aim of these activities is to provide the script content best suited to the requirements of participants and to the specificity of adopting and running e-learning courses.

Each activity has at least one action identified in the field of evaluation or monitoring, such as comparing the outline of the e-learning course with requirement analysis. For each action, input elements were identified, usually in the form of documents to be reviewed or consulted. For those activities highlighted and dedicated to quality management for realizing e-learning projects, the following are also defined: alternative methods of quality management execution, coordinator as the role responsible for supervising activity implementation and, lastly, participants supporting the coordinator. Actions are accompanied by results, mainly in the form of previously developed and improved components or as a list of changes, such as the requirements analysis for the activity of requirements' analysis of e-learning course.

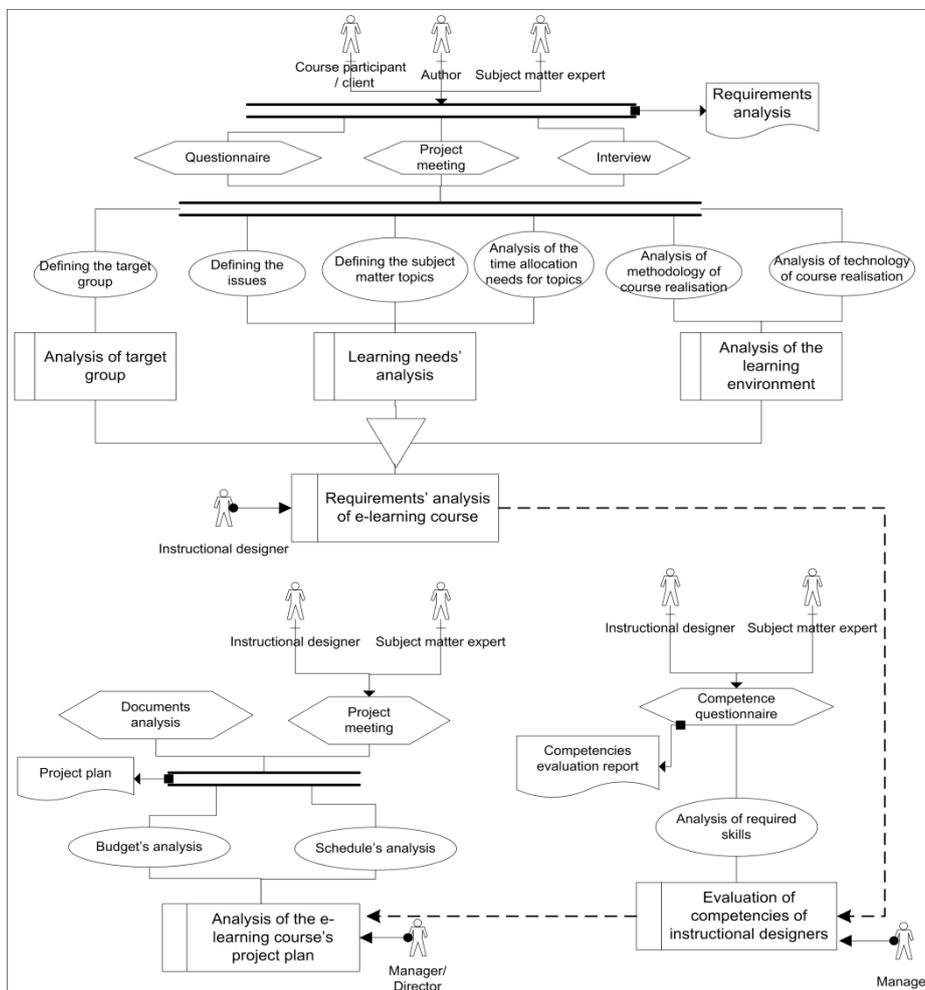


Fig. 2. Quality management diagram for the process of requirements analysis of e-learning course development elaboration

Appropriate quality management diagrams were elaborated for all processes outlined in the e-learning course: requirement analysis, elaboration of script, instructional design, production, implementation and evaluation, and revision (periodical).

Elaborated notation allows developing diagrams that visualize, in a complex manner, the specification of quality management for a sequence of activities identified in processes flow diagrams. It needs verification of assumptions that elaborated quality-oriented modeling for business and project processes supports effective IS project realization. Such evaluation is presented in the third part of the article.

3 Evaluation of an elaborated quality process management modeling approach for processes

Proving the usability of an elaborated quality-oriented modeling approach for processes was only possible by implementing it for specifying processes of real-world projects. Such approach was carried for developing model for managing e-learning projects. It occurred that none additional notation elements, neither modifications were required for modeling quality of processes in projects. It indicated the completeness of elaborated quality-oriented modeling approach and its usability.

Second evaluated element of developed quality-oriented modeling approach was whether it assists in distinguishing of important quality management activities during designing project management models. Therefore verification of impact on quality management of developed model for e-learning projects was conducted in two areas:

- compliance of projects with budgets and schedules by comparing actual and planned schedules and budgets;
- time required for correcting errors connected with design and production processes.

Verification was conducted for six projects of e-learning course development and implementation. For three projects, management was based on the elaborated quality-oriented modeling of processes presented in the second part of this paper. Other projects were based on general project management model developed by PEUG.

Verification of project compliance with budgets and schedules was checked by a comparison of planned and real data. For projects based on project manager's experience and the basic model, serious diffractions were noticed both in the initial stage and in the duration of the process. Detailed analysis has revealed that the main reason for project failure was connected with incorrect quality management. For the design process, they related to lack of substantial consultations for designing multimedia objects and to the evaluation of a list of planned multimedia objects with their initial concepts. E-learning courses' projects realized with the use of a quality-oriented modeling of business processes approach had only minor diffractions from the schedule and were nearly executed precisely as planned.

Quality-oriented modeling of business processes was also evaluated in the field of time requirements for correcting errors connected with the design and production processes, through analysis of quantitative data collected during e-learning project

realization. Fault monitoring was carried out on multimedia objects as they are the most labor-intensive element. The analysis conducted explicitly indicates that the use of an elaborated model positively impacts on the complexity of executing corrective actions towards eliminating errors in multimedia objects.

Results of verification of e-learning project model based on elaborated modeling approach versus general project management justify its usability as a complex solution for designing quality management of processes. They highlight its positive impact on developing models that improve project management especially in the field of quality management.

4 Summary and conclusions

The present study showed the concept of quality management modeling of business processes in IS projects. As a starting point, a review of modeling notations and systems was offered with an outline of their weaknesses. Analysis proved that none of the modeling approaches presented contained diagrams for managing quality in projects. This meant that the integration of quality management with business processes was also omitted. Lack of available modeling approaches for quality management, taken in conjunction with the failure to include aspects associated with them, has required the development of the author notation presented in the second part of the article. Elaborated notation was used in modeling processes. One of the key factors was appropriate integration of quality management with business processes, which was achieved by using stereotypes for activity objects. An elaborated, integrated modeling approach was used in development of a quality-oriented model for managing the processes of an e-learning project.

The article concluded with an assessment of proposed quality management modeling approach. Model verification was conducted by comparing e-learning projects that used elaborated model with those that did not. The results of the research confirmed completeness of proposed modeling approach. They also confirmed that the use of elaborated quality modeling notation allows for better designing of processes, supporting running projects more accordingly to schedules and budgets. It is necessary to point out that analogous verification should be conducted for other than e-learning projects to fully verify modeling approach usability and capabilities.

5 References

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