

Designing Accounting-based Management Information Systems

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Abstract

Accounting-based management information systems (MIS) fulfill two purposes: they record the business transactions over time according to the legal accounting requirements and they provide the information and mechanisms that are needed to manage the enterprise. Consequently business processes and management processes have to be modeled in the Accounting-based MIS design. To allow automated IT support also the information flows in and between the different processes have to be explicitly specified in the design.

For the Accounting compliant modeling of business processes the REA Accounting model introduced by McCarthy [McCa82] provides a solid foundation. In the extended REA model (REAv2) due to Geerts and McCarthy [GrMc02] the accountability infrastructure gets expanded by the inclusion of the policy infrastructure. The policy infrastructure gives the conceptual framework for integrating management processes which finally allows the establishment of Accounting-based MIS. The adequate specification of the management processes and the modification of the REAv2 model needed to develop Accounting-based MIS are discussed in this article.

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Designing Accounting-based Management Information Systems

DESIGNING ACCOUNTING-BASED MANAGEMENT INFORMATION SYSTEMS	2
INTRODUCTION	3
REA BUSINESS FRAMEWORK: STOCK AND FLOW-VIEW	5
CYBERNETIC MGT FRAMEWORK: MANAGERIAL AND SUPERVISORY ACTIVITIES	8
ACCOUNTING-BASED MIS: REA-BASED ENTERPRISE MGT FRAMEWORK	12
ACCOUNTING-BASED MIS: JAVA TECHNOLOGY IMPLEMENTATION	17
CONCLUSION	18
LITERATURE	19

Introduction

The *REA business framework* introduced by McCarthy [McCa82] and extended by Geerts and McCarthy [GeMc02] is an excellent way to express the economic logic behind the business processes in the enterprise value chain. The framework is intuitive and easily understandable especially in the context of a cash economy. It was originally introduced to design interoperable enterprise information systems which can be used in different enterprise domains (e.g. accounting, finance, production, acquisition and sales). This intention lies at the heart of ERP-systems. Hence the REA business framework provides an ideal basis for designing Accounting-based enterprise information systems from the scratch or for semantically guided developments of existing systems.

The ERP market has undergone a fundamental change in the year 2008 where the market leading providers of ERP systems expanded their businesses by buying business intelligence providers. The market leader SAP bought e.g. Business Objects for USD 4,9 bn and increased thereby its balance sheet assets by 1/3. Mergers like these require a huge effort to integrate the ERP functionalities with the business performance management functionalities. For the integration of Accounting and management functionalities the REA business framework is not adequate in its current version as the management aspect is not yet sufficiently developed.

This gap is addressed in this article by discussing the extensions needed for the current version of the REA business framework to include also managerial aspects. The proposed framework is called *REA-based enterprise management framework* as it is based on the REA business framework and it contains the accountability infrastructure as well as the managerial infrastructure at the business and enterprise level.

The REA-based enterprise management framework inherits the *stock and flow-view* from the REA business framework and embeds the thereby modeled business processes within business management systems. In the business management systems the operational business processes and its objectives are initially planned. Over time the processes are executed according to the operating rules specified in the plan activity. To assure the correct execution and the realization of the objectives the business process execution is controlled over time. The control activities are composed out of check activities where deviations are detected and out of act activities where control inputs are given to dynamically align the business process execution with the corresponding operating rules and objectives. Behind such business management systems is the *cybernetic management framework* which describes the management processes in form of its constituent activities, i.e. Plan-, Do-, Check- and Act-activities. The fundamental characteristic of cybernetics that was introduced by Wiener [Wiener48] is the feedback mechanism. The feedback mechanism corresponds to a circular causality where the results of an activity are again influencing the activity. This circularity within management systems is called *PDCA-cycle*. The conceptual idea of the PDCA-cycle goes back to Shewhart [Shew80] who used this

feedback mechanism about 80 years ago for the statistical process control in the quality management domain. Nowadays the PDCA-cycles are the international state of the art of management systems. *The Plan – Do – Check – Act (PDCA) cycle is the operating principle of ISO's management system standards* [ISO-MSS11].

The main problem in extending the REA business framework to the REA-based enterprise management framework is the adequate representation of management processes. Management processes are not yet standardized like business processes are. For business processes there exist different languages which allow the modeling at the business level (e.g. Architecture of Integrated Information Systems (ARIS)) and the technical level (e.g. Business Process Modeling Notation (BPMN) and Business Process Execution Language (BPEL)). To capture the essential informational aspects the management processes are modeled in this article in the unified modeling language UML [UML07] as activity diagrams. These diagrams are called *MGT-activity diagrams* to indicate the managerial context of the activity diagram where next to the managerial activities also the corresponding information flows are modeled. The MGT-activity diagrams use a *generic management language* which allows the specification of different management system variants (e.g. open and closed loop systems, single and double loop systems and reactive and proactive systems). This conceptual flexibility is essential to make the cybernetic management framework applicable not only at the business management level but also at the enterprise management level.

The REA-based enterprise management framework provides a sound economic and managerial foundation upon which Accounting-based MIS can be designed. For the design of management information systems it is important that the stock and flow-view at the business and management architectural level can be directly translated into the information system architecture. This requirement is fulfilled by using UML defined MGT-activity diagrams as thereby the object orientation of UML carries over to the business and management architecture. On the other side the object orientation in the information system architecture is also directly connected via the object oriented programming technology to the information technology architecture. The REA-based enterprise management framework therefore not only allows the design but also the implementation of Accounting-based MIS. At the Institute of Management Sciences (Vienna University of Technology) a prototypical application of an Accounting-based MIS was implemented in the Java technology to show that and how the implementation works.

This article is structured as follows. After the previous introduction the REA business framework is presented. Thereby the duality and the reciprocity principles are combined in the generic business case artifact to make the REA business framework better usable in the Accounting domain. After that the cybernetic MGT framework is presented. The MGT-activity diagrams are thereby specified as cybernetic PDCA-cycles that are integrated at the policy infrastructure level of the extended REA model. The resulting REA enterprise management framework is presented next. After that the prototypical implementation of the Accounting-based MIS derived out of the framework is shown. The final section concludes the article.