



## Why accounting data models from research are not incorporated in ERP systems

2<sup>nd</sup> International REA Technology Workshop  
June 25th, Fira – Santorini Island - Greece

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## Introduction

Goal Accounting Data Model research:  
Proposing data models which overcome double-entry bookkeeping / application drawbacks

Research results: 'Grundrechnung' and 'REA model'

Questions:

1. Why are these models not adopted in ERP systems ?
2. What is the contribution of 'Grundrechnung' and 'REA for ERP systems



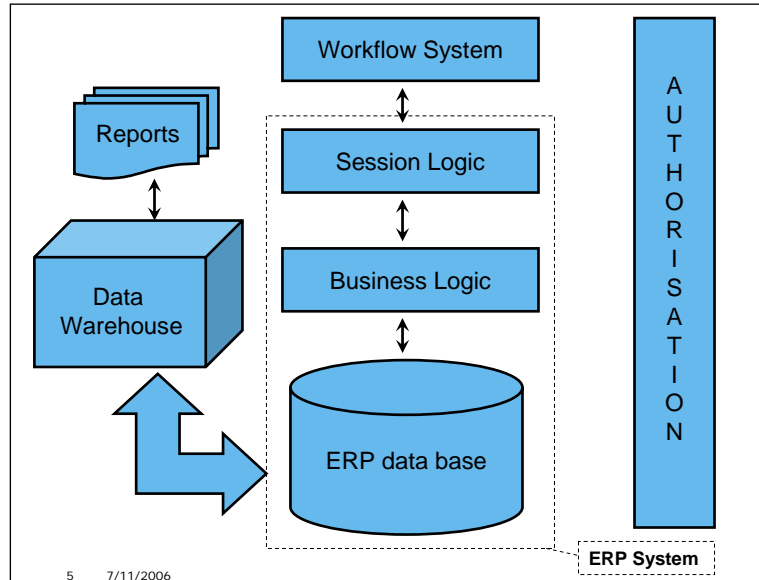
## Goals of Accounting Data Model Research and ERP systems are similar

- Accounting Data Model Research:
  - Storing objective data, independent from application scope (overcome drawbacks double-entry bookkeeping)
  - Suitable for a wide range of existing and new applications ('application-neutral' data model)
  - Reusability, Extendibility (Everest, 1977)
- ERP Systems
  - Organization's central info. system for many users over a long period of time of change
  - Support existing and new applications for current and new users
  - Central question: can the ERP data model over time continue to provide the required data ?

Can ERP System's architects benefit from research results ?  
Why haven't they done this already for the past 20 years ?



## Components of an ERP system



## How Financial data is supported in current ERP systems ?

- ERP systems are being built based upon a selection of user requirements, frozen at a point in time and developed in the ERP system
- ERP business logic as well as required data model changes are being driven by chosen requirements (i.e. 'application specific')
- Double-entry bookkeeping is most widely used – hence a very homogeneous request from all finance users to all ERP vendors

This explains why double-entry bookkeeping is the foundation of all ERP data models today  
Because of the ERP design method, double-entry bookkeeping is not only an application but also the data model



## Drawbacks of current ERP approach Preliminary findings

- Restrictions to support new logic apply when application features are embedded in the data model (McCarthy, 1980, 1982, Everest and Weber, 1977, Vandenbossche, 2005)
- ERP data model architects ignored this advice for > 20 years. Reasons: efficiency, technical limitations, existing design methods, etc.
- No fundamental separation between data model and business logic

Main reasons why 'Grundrechnung' and 'REA' are not adopted in ERP systems:

1. ERP does not separate business logic from data environment
2. Difference in design methodology: ERP = application specific, REA/Grundrechnung = 'purpose neutral', 'application-neutral/independent'



## Grundrechnung - History

Originally defined when business information & IT systems did not exist yet:

- Germany: Schmalenbach (1956)
- US: Goetz (1939) ('Basic Pecuniary Record')

Operationalized by Riebel (1994): 4 design principles (no data model!)

Riebel's data recording principles are relevant to investigate since they have been defined from an application-independent perspective



## Contribution of 'Grundrechnung' for today's ERP data models

### #1: No heterogeneous classification or summarization of elements needed separately for applications

- What ? Data to be recorded in it's original form
- New and important when database space and hardware were expensive
- Now outdated:
  - Modern DBMS are inexpensive
  - Summarized data are sometimes stored in a separate data warehouse

### #2: No arbitrary division and allocation of data

- What ? Separation data environment and application environment
- Defined initially to guarantee flexibility for German Cost Acc.
- Now: separation is a common design technique, BUT the data environment is not 'objective', 'application-independent'

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## Contribution of 'Grundrechnung' for today's ERP data models (2)

### #3: Entries to be recorded at the lowest level

- Today, ERP systems record transaction at lowest level
- Sometimes, secondary summarization recordings take place for optimization reasons.

### #4: Characteristics will all attributes of interest and importance

- To be understood as: 'only neutral, relevant and recurring data is to be stored in the base data environment'
- ERP's store all relevant data, BUT influenced by a chosen application scope.

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## Conclusion on contribution Grundrechnung

- 'Grundrechnung' defined 50 years ago when IT systems not commonly used
- Separation of data environment and application environment followed by ERP's, but data in ERP's are not application-neutral
- Most concepts of 'Grundrechnung' are now outdated (e.g. solved by data warehouse)
- 'Grundrechnung' does not provide guidance on how to organize a 'purpose-neutral' data model
- This guidance is delivered in the REA model

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## REA Model - History

- Initial REA model: McCarthy (1982): E-R, scope: historic transaction data
- REA Ontology and Extended REA model: Geerts and McCarthy (2000, 2002)
- Object Model of the Extended REA Model: Hruby (2004)

REA does provide an Application-neutral Data Model  
ERP systems need to support new applications for future users

Question: Why not using REA as data model of ERP ?

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1. The Extended REA model is proposed as object data model but current ERP data models are designed following traditional design methods

- Accounting data model research makes use of newest data model techniques (OO)
- Commercially viable software applications only now emerge
- Largest ERP systems are now 15-20 years old and use traditional design and development methods
- Given market maturity, no new ERP systems are being build

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2. The extended REA model provides concepts to store future and past data consistently. These concepts are useful to build new ERP systems, but cannot be implemented as extension of existing ERP data models

- REA model expanded from only historical data towards historic and future data via one single concept
- Current ERP systems are more an automation of a bookkeeping system.
  - Heavy focus on past data
  - Data model defined around General Ledger
- Can ERP systems be enhanced with REA concepts for adding future data ?
- No – the General Ledger in ERP has to be replaced by REA for historic data first

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3. The extended REA model provides concepts and relationships to define business event data in coherence at data level. These concepts are useful to build new data models but cannot easily be implemented as extension of current ERP data models

- The REA model recognizes transparent 'coherence' between data events (e.g. REA Value Chain)
- In current ERP systems, 'coherence' is specific and defined
  - In data models inside and outside Finance
  - Hard-coded in business logic
- REA provides a significant contribution in this area. But: REA concepts cannot co-exist with (hard-coded) coherence of an ERP.
- Predefined coherence in ERP should be removed first prior to introducing the transparent concept of REA

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4. The extended REA model still lacks specific detail and certain concepts to record all data used in an ERP system in an explicit way

- REA proceedings have been published at a conceptual level, without design-specific detail
- ERP designs require an additional level of detail compared to the detail, today available in REA publications
- Some concepts are still missing in REA (e.g. the fulfillment of exchanges) or are implicitly assumed (e.g. terms and conditions of dual relationships)
- Entity types like order, invoice, etc. could be argued as 'aspects of reality' and be a legitimate part of the data model

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5. The extended REA provides concepts to define business processes explicitly in the same framework as business event data

- ERP systems do not recognize business processes explicitly
  - implicitly supported in ERP business logic
  - External Workflow tools can be integrated to make the business process more explicit
- REA provides a framework in which business processes and data can be represented jointly. To be considered as significant contribution.
- Can the REA extensions for business process definition be adopted in ERP ?
- No – pre-defined business process steps in ERP business logic have to be removed first, to avoid conflicts



### Conclusion on the contribution of the REA model for ERP data models

- Co-existence of extended REA model and current ERP data models based upon double-entry bookkeeping out-rule each other.
- Hence, complementary concepts offered by REA cannot be implemented as extension of current ERP systems
- REA concepts only useful when building a new ERP data model, not for extending existing data models. Some REA concepts are missing or lack detail
- Significant contribution of REA compared to current ERP data models in the area of:
  - Definition of future data transparent with past data
  - Definition of coherence between business processes
  - One single framework for business processes and data definition



## Conclusion

- Goals of ERP and application-neutral accounting data models as 'Grundrechnung' and REA are similar
- On Grundrechnung:
  - Contribution = Strict separation of application area and data area. ERP systems do support this today
  - New set of data storage rules is required, which focuses on solving today's ERP problems



## Conclusion

- On REA
  - Contribution = Multiple concepts as discussed earlier
  - Reasons why none of the REA concepts is adopted today relate to the following facts:
    - concepts of REA and ERP conflict
    - REA expressed in OO design method
    - Some concepts and concept detail are missing



## Future research

- Focus on defining REA extensions which can co-exist with current ERP data models
- Journal articles on additional concepts and detail of the REA ontology
- Joint cooperation between IT and Accounting. 'evangelize' REA concepts and benefits for ERP data model architects



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