

Analysis and Design of AIS based on REA Accounting Model

Rexhina Blloshmi¹, Igli Hakrama²

Department of Computer Engineering, Epoka University, Albania,

rblloshmi12@epoka.edu.al, ihakrama@epoka.edu.al

Abstract: Accounting information system (AIS) is a way being used by businesses to generate accurate record keeping and financial reports and also to keep data secure by processing information provided by users which can be used by all interested parties that have legitimate access. There are a lot of problems related to traditional accounting systems and modern accounting models are required to give more efficient solutions about those problems. Among different accounting models discussed in this paper we have chosen REA to implement an integrated enterprise system. It is provided a detailed analyses of REA and also the design of this model that helps us in implementing the system. We believe that a well-designed accounting model is a competitive advantage for organizations that adapt it.

Keywords: Accounting model, information systems, REA, AIS, MVC

1. INTRODUCTION

One of the most important functions in a business is accounting. It is considered to be the language of business. Accounting origin dates back to ancient Mesopotamia while first auditing systems originate from old Egypt and Babylonia, and it is highly correlated with the development of counting, writing and money. Nowadays IT people are trying to give computer based solution to every real life problem. Technology is developing with gigantic steps and it is spreading its activity in every field, especially in business. It is thought to be one of the success catalyst in enterprises since it makes every process faster and more accurate. Since accounting is a function that is used for internal management decisions and also for external informative report to interested stakeholders such as shareholders, investors, taxation authority and other parties that interact with the enterprise, it is of high interest to work in eliminating inefficiencies in this field. Accounting Information System is the set of all technological attempts to optimize accounting in enterprise. It is a subset of Management Information system (MIS) and it is responsible for recording and creating well-structured and accurate financial reports that aid managerial decision making and also informing interested parties about financial health of the enterprise. One of the challenges that face IT people since 20th century is implementing an accounting model that best fits the requirements of ERP systems, such as integrating most common functional areas of an enterprise in one system, operating in real time and not relying on updates that take place once in a period of time. Such a system supports activities between different departments such as sales and marketing, human resources (HR), finance and accounting, production and manufacturing, and this is achieved due to a central database that stores information about all these activities and this information can be used by interested departments thus increasing overall performance of the enterprise through communication and interaction. It is said that accounting is in the center of ERP systems. In this paper it will be analyzed and designed an AIS system based on REA accounting model. REA was presented in 1982 by McCarthy and it serves as one of the best models in implementing an AIS and also ERP systems. In the analysis and design part of this paper we are going to explain REA features and also the REA structure for a manufacturing company which

includes most of the functional areas of a business such as sales, purchases, accounting and finance and manufacturing. Then in the implementation section, it will be given information about the technologies used and how these technologies are cooperating with each other in building this system. To conclude we list the competitive advantages of REA, revise the work done so far and propose future improvements in the implementation of the system.

2. STATE OF ART

Accounting Information Systems is one of the most actual fields where IT people are giving their attention and contribute to build more sophisticated data models that cover all business requirements. Before such systems were developed, accountants recorded every transaction and financial data manually, which might lead to errors and some information might be left out. AIS not only make this job easier but also at high accuracy. A lot of data models are analyzed and designed by economists and IT people. Hoberman (2009) defines data model as a tool that aids both businessman and IT people to explain the set of real information accurately by using symbols and text in order to improve the internal communication in an organization thus leading to a flexible application environment [5].

2.1. Problems with traditional accounting systems

A lot of organizations are still using traditional accounting systems that appear to have a lot of problems that can be eliminated in the computer based systems. Such problems are redundancy and data duplication. Also traditional accounting systems are used only by accountant and it is difficult to be understood by non-accountants. Double entry bookkeeping, debits and credits just increase the duplication of data and lower the performance of the whole system. Double Entry is not a concept of redundancy even though term double may suggest so, the way of how the data are stored is redundant. Double entry bookkeeping is a way of preventing system usefulness, since the data cannot be manipulated easily to generate reports of certain purpose or be used in other processes. Therefore the range of users that can use the data is also restricted [1]. Some of latter AIS such as REA or IAC get rid of accounts such as Accounts receivable and payable since they are redundant information that can be calculated in real time by simple queries.

2.2. Items, Agents, Cash accounting model (IAC)

IAC is an accounting model that is presented in 2004 by Salim and Ferran in their paper "IAC Accounting Data Model: A better data structure for Computerized Accounting Systems" [3]. IAC accounting model is designed to remove redundancies of traditional accounting. In case of a purchase on account, with traditional accounting approach it has to be stored in invoice, bank journal and in the account payable account. So the same information is stored in three different places causing unnecessary data to be stored in the database. IAC model removes a lot of redundancies and enables detailed financial reports to be generated by the aid of a well-structured database. In case of an account receivable or payable, in order to remove redundancy IAC stores information in one table named AgentTransaction. In the same logic it removes other data redundancy in the model.

2.3. Events accounting system (EAS)

EAS is an accounting system that was firstly presented in 1969 by Sorter [9]. He stated that an accounting model should maintain the economic events related information in order to enable the users to generate their reports according to their inputs in their own model. Events accounting requires to record and disseminate information instead of forecasting or summarizing. Different from traditional accounting systems that use ledgers and journals to record information, EAS uses so called base elements which are multiple entries that contain aggregated information. Benita Cox has highlighted the importance of accountability and usefulness of information for an AIS [1]. According to her assumptions, a limitation in existing AIS is that they are modeled according to data perspective rather than a strategic one. A good approach would be if it meets the requirements of multiple users. A combination of EAS with an organization's strategic business plan, which meets the requirements, is SISP. The strategic perspective enables EAS to collect information from multiple users and not only accountants. Benita Cox concludes that a lot of work is to be done in order to integrate and extend the SISP approach and translate the organization objectives into data requirements, to ensure that different users' interests are met.

2.4. Resources, Events, Agents (REA) accounting model

REA accounting model was firstly represented in a paper written by William M. McCarthy in 1982 as a framework for building accounting information systems in a shared data environment [8]. REA is a model for re-engineering accounting for computer age. One of the main initial objectives of REA was to switch isolated functional driven system by an integrated information system. Then the aim of REA framework was to build a whole enterprise wide architecture. REA optimizes accounting information systems by excluding some unnecessary data objects and emphasizes the importance of real objects such as resources, events and agents. One of the features of REA is to keep atomic information, which allows building a flexible framework and the challenge of building a system is to make it efficient maintaining the simplicity of REA accounting model. In 1998, Nakamura and Johnson presented a framework which was based on REA. They state that even though REA was presented by McCarthy as an accounting model it can be used in different business areas such as control inventory, payrolls etc. [7]. Fallon and Polovina, in 2013, explain an architecture that is totally based on REA principals which improves business process modelling in ERP systems [2].

3. ANALYSIS AND DESIGN OF REA

Resources are everything that have economic value to enterprise. They are owned by the enterprise and are scarce. Resources are used in economic events by agents and their amount increases or decreases. In order for an economic resource to increase another one should be decreased. Most common examples of resources are raw materials, inventory, cash etc.

Events are processes that effect the increment or decrement of resources in the enterprise. Events are categorized as economic events or support events. Economic events are those processes that affect the amount of resources owned by the enterprise such as purchase, sale, produce processes. Support events are those processes that does not affect the amount of resources owned by the enterprise. More generally

those events include planning, controlling or informing for a specific case but do not cause a change in resources.

Agents are departments or even individuals who are participants in events. They have the ability to affect the economic resources. They can be internal agents or external agents. In the internal agents we can mention managers, accountants, workers etc., also called Employees. In the other hand, external agents can be Customers that are involve in sale event and Suppliers that are involved in purchase event.

One of the most important features of REA is duality. In every event there must be at least two agents, one of the agents gives and the other receives. One increment event is related to a decrement event thus if one of enterprise resources is to be increased another one will decrease, so one of the agents has to give a resources in exchange of another resource owned by the other agent.

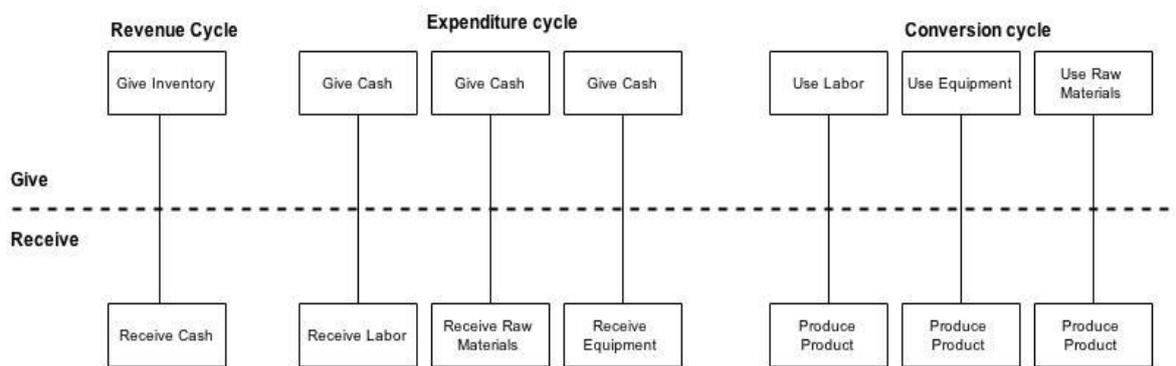


Fig. 1: Economic Events shown as duality give and receive [4]

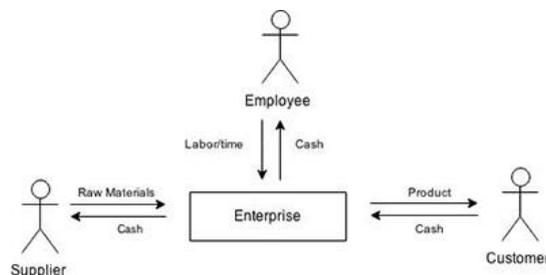


Fig. 2: Internal and external agents in an enterprise [6]

3.1. REA Diagrams

In order to better display REA diagrams we are going to analyze in details the resources, events and agents and relationships between them in expenditure cycle in a manufacturing company. Let's suppose that the company has to buy raw materials for production.

To build a complete REA diagram 4 steps must be followed:

- Identify events
- Identify resources
- Identify agents
- Identify the associations and cardinalities between each entity

3.1.1. Events

Check Raw Materials is a support event because it does not affect the amount of resources of the company. Production manager is gathering information to allocate the resources needed in order to produce the required product by the customer.

Order Raw Materials is a support event. It is a commitment to buy a certain amount of items from the supplier in the future but does not directly affect the resources.

Receive Raw Materials is an economic event. The raw materials account is increased directly when a product is received from supplier. This is the increment half of the economic duality.

Disburse Cash is an economic event and it is the decrement half of the economic duality. This event directly affects cash resource by decreasing it.

3.1.2. Resources

In the expenditure cycle example there are two resources affected by the economic events. In the Receive Raw Materials event the raw materials resource is increased and in the Disburse Cash event cash resource is decreased.

3.1.3. Agents

The only external agent related with all the events is Supplier while the internal agents are instances of Employee entity which are raw materials clerk, purchasing clerk, receiving clerk and cash disbursement clerk.

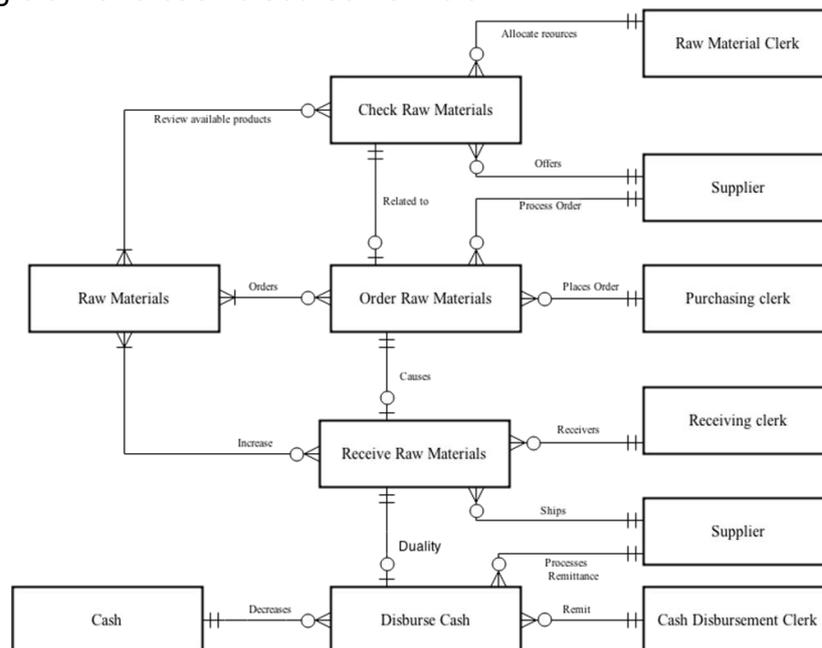


Fig. 3: Associations and cardinalities between entities in expenditure cycle

3.1.4. Associations and Cardinalities

- Association between Check Raw Materials and Order Raw Materials events

When a production manager allocated the resources needed for the production of a certain product, he/she check the resources for raw materials needed. If raw materials needed are missing, purchasing clerk orders them. The cardinality in the Check Raw Materials side is 1:1 which means that for each Order Raw Materials event a Check

Raw Materials event has happened, while the cardinality in the Order Raw Materials side is 0:1 meaning that the purchasing clerk decides to buy the Raw Materials or not.

- Association between Order Raw Materials and Receive Raw Materials events

If the purchasing clerk orders a product, the receiving clerk must wait until the product is shipped by supplier. During this time no ship has occurred. So there is 1:1 cardinality exists in the Order Raw Materials side and a 0:1 cardinality exists in the Receive Raw Materials side. The zero cardinality shows the time difference between the moment when the raw materials are ordered and when they are received.

- Association between Receive Raw Materials and Disburse Cash events

Receive Raw Materials and Disburse Cash are two duality processes. Receive Raw Materials is the receive half of the duality and Disburse Cash is the give half of the duality. The cardinality in the Receive Raw Materials side is 1:1 because for Disburse Cash to happen, a Receive Raw Materials event must have occurred. While the cardinality in the Disburse Cash side is 0:1 and this zero shows the time difference from the moment the raw materials are received to the moment the cash is disbursed.

- Associations of the Events with Agents

Each event has the cardinality 0:M in association with agents and each agent has the cardinality 1:1 in association with events. 1:1 cardinality of agents means that one event must have an agent representative and the 0:M cardinality means that an agent can be participant in an event many times or none.

- Association of Events and Resources

- Disburse Cash event and Cash resource

The cardinality in the Cash side is 1:1 meaning that there is only one cash account while the cardinality in the Disburse Cash side is 0:M meaning that cash can be paid to one or many suppliers but it is withdrawn from only one Cash account.

- Check Raw Materials, Order Raw Materials, Receive Raw Materials events and Raw Materials resource

There exists a many to many relationship between each of these events and Raw Materials resource. In the relationship between Check Raw Materials and Raw Materials, the many-to-many relationship means that the production supervisor's request may involve one or many items in Raw Materials while the items of Raw Materials can be requested zero or many times by the production supervisor. So in the Check Raw Materials side there is a 0:M cardinality and in the Raw Materials side there is 1:M cardinality. In the same logic in the relationship between Order Raw Materials and Receive Raw Materials events with Raw Materials resource, the order/receipt might involve one or many items of Raw Materials, while the items of the Raw Materials might have been ordered or receipt zero or many times.

4. IMPLEMENTATION

In order to build an integrated AIS based on REA we have chosen a web application since it is more flexible and can be accessed despite location. The programming language in which the application is build is object oriented PHP. The whole application is build according to a Model-View-Controller (MVC) structure. The model part is the representation of REA entities, view is what is being displayed to user and controller controls how the model entities are shown in the user view. The system will take information about transactions as input from the user and will generate financial

reports and also managerial reports such as inventory state, remainders about orders and also summarizing and forecasting. The system is available online¹.

5. CONCLUSION AND FUTURE WORK

Applying technology in business is not only about building system that shorten the job, but they must ensure accuracy, reliability and performance. This was not offered by traditional accounting systems. By studying new models such as REA and with a little effort we can build very good systems that will increase the overall performance of the enterprise. REA's advantages can be seen mostly from the value chain. Companies, to remain competitive must differentiate between their activities, and while doing so they become adaptable and responsive to the changing environment. The REA approach to business process modeling aids managers to focus on core economic events and also makes possible identifying non value added activities so they can be eliminated. This improves efficiency which results in increased overall productivity. Storing both financial and non-financial data for business events in the same database reduces the costs of storage and maintenance and also reduces the need for multiple data collection. Financial and nonfinancial data storing allows a wider perspective for management decisions via the support of multiple views. REA supplies timely, relevant and accurate information. This results into high quality products, flexible production and significant improvement in customer service.

In the future we intend to include more functional areas in the system such as human resource planning, marketing etc. Also a detailed implementation of the current processes needs to be done so they can be used by a wide number of businesses despite their operating sector.

6. REFERENCES

- [1] Cox, B. (2003) Accountability lost: the rise and fall of double entry, *Omega-International Journal of management science* (0305-0483), 31, 303-310.
- [2] Fallon, R. Polovina, S. (2013) REA Analysis of SAP HCM; Some Initial Findings. Dresden, Germany.
- [3] Ferran, C. Salim, R., (2004) IAC accounting data model: A better data structure for computerized accounting systems. *Review of Business Information Systems* 8, 4.
- [4] Hall, J. A. (7th.)(2010). *Accounting Information Systems*. USA.Cengage Learning.
- [5] Hoberman, S. (2nd.)(2009). *Data Modelling Made Simple*. Bradley Beach, USA.Technics Publications.
- [6] Hruby, P. (2006). *Model-Driven Design using Business Patterns*. Berlin, Germany, Springer.
- [7] Johnson, R., E., Nakamura, H. (1998). *Adaptive Framework for the REA accounting model*. Illinois, USA
- [8] McCarthy, W., E.(1982) The REA accounting model: A Generalized Framework for Accounting Systems in a Shared Data Environment. *The Accounting Review*.
- [9] Sorter, G. (1969) An 'events' approach to basic accounting theory. *The Accounting Review* 44, 12–9.

¹ <http://stud-proj.epoka.edu.al/~rea>