The International Journal of Digital Accounting Research
Vol. 7, N. 13, 2007, pp. 1-25
ISSN: 1577-8517

From an Object-Oriented Approach to the Financial Reporting: An Open Architecture[1]

Clara Silveira. Escola Superior de Tecnologia e Gestão da Guarda. Portugal. silveira_ipg@hotmail.com

Rute Abreu. Escola Superior de Tecnologia e Gestão da Guarda. Portugal. ra_ipg@hotmail.com

Fátima David. Escola Superior de Tecnologia e Gestão da Guarda. Portugal. maria.david.2@netvisao.pt

Abstract. This paper developed an Object-Oriented (O-O) approach as an open architecture for financial reporting that is based on the notation Unified Modelling Language (UML) and the Rational Rose® tool. The O-O approach integrated into the financial reporting has interoperable building financial statements that must be available to be included in any economic and financial analysis of a corporation. The implementation of an open architecture for developing financial reporting is supported by the systems analyst work that observes and understands the general domain of financial reporting, as well as, input from the specialists, directors and stakeholders of

[1] The authors are grateful to the anonymous reviewers for their insightful comments on an earlier draft of this manuscript. Ideas expressed in the article are those of the authors and should not be attributed to any organization.

Submitted July 2007

Accepted September 2007

DOI: 10.4192/1577-8517-v7_1

the corporation. Then, with reference to the Portuguese experience, the research scope is towards a basic structure of financial reporting whose results are applicable to any corporation. The further implication of the architecture for the financial reporting is to built a prototype to answer the market needs.

Key words: *Object-oriented, financial reporting, information systems*.

1. INTRODUCTION

The purpose of this paper is to develop an Object-Oriented approach as an open architecture for financial reporting. The "old" problem of creating an information system still exists and which is the best adapted to a specific corporation, with minimum development expenses. Object-Oriented (hereafter O-O) approach is subdivided in analysis and design that will develop construction methods of the information systems (hereafter I-S). The basic concept of O-O supports the creation of software which is both adaptable to change and economically feasible. The results of this construction also reduce the risk of developing complex software.

The research scope is towards a basic structure whose results are applicable by any corporation on financial reporting with reference to the Portuguese experience, specifically to the financial statements, in that the information modelling is justify by the O-O approach. The authors develop a model based in the notation Unified Modelling Language (UML) and use the Rational Rose® tool. The model is independent of the programming language, the used tool and the software development process. The UML is a graphic language that specifies, visualizes, builds and documents engines of a complex software system (Booch et al. 2000).

The systems analyst observes and understands the general domain of the financial reporting, as well as listen specialists, directors and stakeholders of the corporation. This analyst filters the domain through the understanding of specific aspects related to the reporting system (Coad & Yourdon 1991) and, further, builds a model or prototype for processing the financial reporting information. However, the O-O approach requires a major shift in thinking by all stakeholders involved in the corporation and its environment.

To fullfield the purpose of this paper, it is described the O-O approach, for afterwards integrated it on the financial reporting subdivided by each financial statement that is included in the economic and financial analysis of the corporation. The implementation of an open architecture for developing financial reporting model based in the Portuguese accounting environment is presented with concepts and methodology. This process is based on three fundamental principles: abstraction, encapsulation and inheritance, that have revenues as protected systems, that is, comprehensible and maintainability easiness, as well as total cost reduction of the life cycle information system, allowing to create mechanisms to model the reality.

2. THE OBJECT-ORIENTED APPROACH

Knowledge has begun to take the place of capital as the generative force of the corporation (Drucker 1996). As result, society tries to create dynamics to develop knowledge, very different from the past, when knowledge was a secret. To make this possible, I-S has emerged as a group of key factors among the implicated people, processes and resources in the gathering, processing and availability of the information inside of the corporation (O'Brien 1993 and Piattini et al. 1995), as shown in the Figure 1.

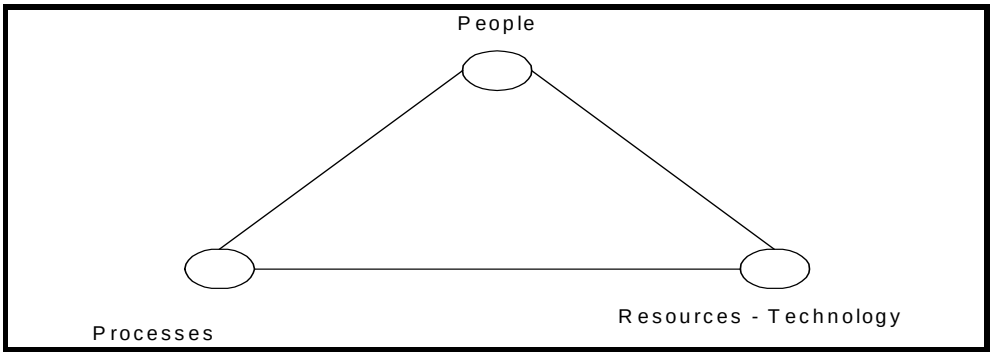

Figure 1 Key Factors in the Software Development Process (Piattini et al. 1995)

The key factors in this development process affected new ideas that can appear from any source: individual users and in groups, development and marketing team, among other economic agents. Thus, this paper presents the O-O approach as an open architecture for the financial reporting.

The authors centre the O-O approach in the software engineering context. The methodology is, usually, presented in phases or tasks series, with techniques and notations associated each one of them, forming a coherent set of methods used in the construction process (Pressman 2000). The method is an organized collection

of notations, techniques and formal or semi-formal procedures to model one or more activity of the financial reporting or another. Therefore, the method proposed by Booch (1994) consists on integrated techniques collection that includes micro process activities and macro process phases, which were applied to whole the information systems (see Figure 2).

The Figure 2 presents the micro and macro development process subdivided by: the micro process activities that is more closely related to the Boehm´s spiral model in terms of different types of refinements, and serves as the framework for an iterative/incremental development (easy to add to the architecture); and, the macro process phases that is closely related to the traditional waterfall life cycle (the oldest methodology know for developing an automated data system), and serves as the controlling framework for the micro process. Complementary, the micro process is concerned with the individual developer or a small group of developers, while the macro process is concerned with the software management team (for truly massive undertakings) (Booch 1994). A group of tasks analysis is defined at the micro level and it is reapplied in each task of the macro process.

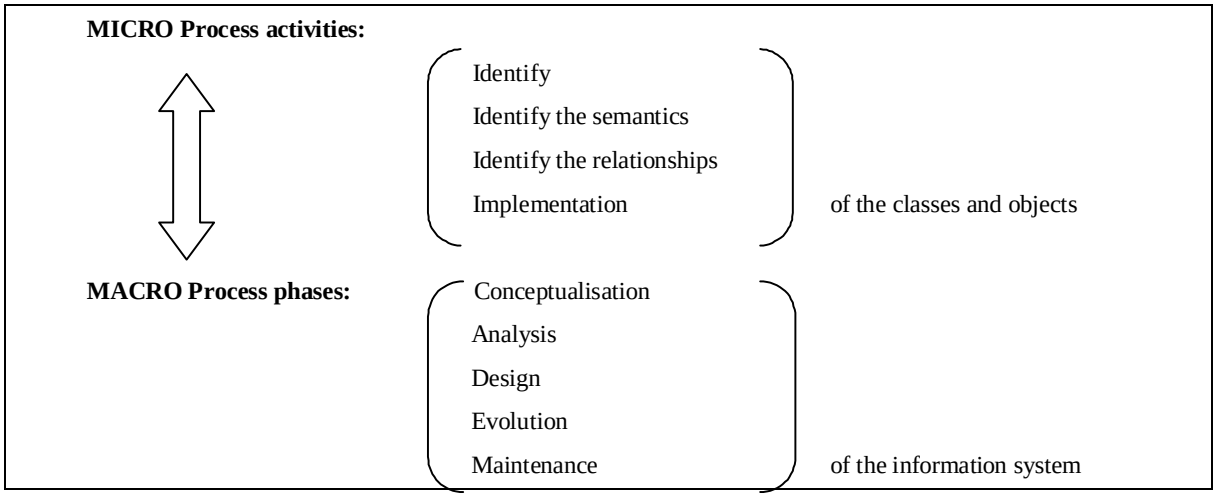

Figure 2 Micro and Macro Development Process (Booch 1994, adapted)

Thus, an evolutionary approach is maintained, for that the systems analyst (or requirements engineer) has, that according to the methodology proposal by Booch (1994), to do the interaction of the O-O approach with financial reporting. Begins in the micro process, based on a tasks set that perception the needs of the financial analyst involvement in the development process and identify the classes and objects at a given level of abstraction to establish the boundaries of the problem at hand; semantics of these classes and objects to establish the behaviour and

attributes of each abstraction identified in the previous phase; relationships among classes and objects to solidify the boundaries of and to recognize the collaborators with each abstraction and implementing classes and objects to provide a refinement of existing abstractions.

In the O-O approach of this research, an object is an entity that exists in the time and space (i.e. computers), with specific name (i.e. HP Compact), visibility of other and for other objects and instance of a class of behaviours. An object is defined in class hierarchy via its sub-class (i.e. administrative equipment), class (i.e. tangible fixed assets) and super-class (i.e. fixed assets), which determine everything about an object. A super-class may have any number of sub-classes and classes. Objects are individual instances of a class. On its side, a class is the description of more objects by means of a uniform group of attributes and operations. As it can be observed, in the O-O paradigm, functionality is achieved by collaboration among objects and in the O-O terminology. The object fixed assets has inherit behaviour from different classes, each class providing one or more of the required behaviours. This property of object-oriented systems is called multiple inheritances.

The system according to an O-O approach has different characteristics from other system developed according to functional techniques. The construction is made itself in abstraction extracts (sub-systems), in that each extract is constituted by objects and classes collection with reduced visibility of another extracts. From where, the components of a same sub-system have a flowing structure and not nested rigid, being the flow of control more fluid and the objects must be independent and autonomous.

Effectively, there are differences between O-O and other methodologies. The O-O contains a code (sequences of computer instructions) and data (information which the instructions operate on) and in the other traditional methodologies code and data have been kept apart. In this perspective, Booth et al. (2000) defend that the new technologies as the O-O approach will revolutionize the information management, especially in the Enterprise Resource Planning (ERP) market. For example: i) Developing international sellers of ERP-software, such as: Computer Associates, Inc®, Cincom Systems, Inc®, GEAC®, IBM®, IFS®, Intentia®, JBA International®, J.D. Edwards®, Made2Manage®, MAI Systems®, Marcam®, Mincom®, McDonnell Information Systems®, Oracle®, PeopleSoft®,

PivotPoint®, PowerCerv®, QAD®, ROI Systems®, Ross Systems®, SAP AG®, Systems and Computer Technology®, System Software Associates®, Symix Computer Systems® and Tetra International®; ii) Providing solutions for complex functional areas of the corporation, like: accounting and management, production and materials management, quality management, plant maintenance, sales and distribution, human resources management and project management; and iii) Implementing new accounting practices, such as: activity based cost and management, balanced scorecard, shareholder value analysis and intellectual capital methodologies.

Therefore, the information provides by the financial reporting has support on the accounting information. It is not more than one of the information sources in the software systems development. In fact, main sources of the O-O consists, among others, in obtaining systems more defended in relation to attempts of corruption and in reduction the total cost of the information system life cycle, with particular attention to the maintenance expenses, larger comprehensive, maintenance facility, reduction of development risk and productivity increase. These O-O models progress as different databases and search engines became available to enlarge the system further in work to the corporation. After the corporation agrees and accepts the final version of the code, the outcome of the system shows what it was been learned from the experience.

Complementary, an open architecture is related with specifications, which are public and as the opposite is proprietary. The example purposed in this paper, being an open architecture, present as great advantage the availability to anyone add-on products for it and as disadvantage it allows others to duplicate it. However, it is the opportunity to minimize wrong behaviours and to maximize innovations. Another lesson of this explosion of good behaviour is Internet, which is built on standard interfaces, TCP/IP protocols, a basic data format, and a uniform identifier or addressing mechanism. All the information needed regarding the interconnection aspects is publicly available (Hauben 2001).

3. FROM THE OBJECT-ORIENTED APPROACH TO THE FINANCIAL REPORTING

One of the characteristics of the financial reporting is publicly available. This essential to all the stakeholders knows and aids to their decision-making process.

Quantitative information is less likely to be misunderstood than qualitative information and this is one important features of accounting information. However, it takes time and effort to collect and process and so is costly to produce. These questions exist, because information has an economic value, by which intends to improve the application of resources in the global economy, in what refers to the wealth distribution among citizens and corporations, as well as the formation of the productive capital (Giner 1995). Although, this information needs to be provided in time that allows being relevant to the purpose for which was made (Crowther 2004).

One corporation choose a depreciation methods, a stock cost methods, a reporting period and each option make financial report different form another one. The general ledger contains all of the financial accounts of a corporation offers unlimited financial reporting capabilities. All the financial statements are modified simply select formatting options that allow to build a specific report that answers to the needs of information. To minimize these differences, the authors used the O-O approach. This allows managers to develop more easily and efficiently management skills. Also, the interpretation of the information contained in the statutory report is based in a proposal of the financial reporting support in six financial statements related with mandatory disclosure of information. In this sense, this research is centred in the structure and in of the Portuguese Plano Oficial de Contabilidade (POC), for best understand the limitation and the quality of the accounting information that will build the more appropriate information system. Similar methodologies were developed by several authors such as: Chu (1992), Murthy & Wiggings (1993), Adamson & Dilts (1995), Windcliff et al. (2003) and Verdaasdonk (2003). The POC was approved by the Decreto-Lei n.º 410/89 of November 21 (MF 1989), but it is not applied to banks, insurances companies and other entities on the financial sector, because they have specific accounting plans that must applied (Bento & Machado 2002). However, in these sectors, the approach developed in this paper can be applied because the financial information contained in the statutory report is also support in the six financial statements. In this sense, several of economic activity sectors have specific accounting plans, in consequence of legal control and accounting needs, for example the accounting plans for the: local autarchies; education sector; health sector; institutions of the solidarity and social safety system; and sport federations, associations and clubs (Abreu & David 2006).

To obtain a true and fair view of the accounting information system, the corporation decide about the periodicity (time period assumption), because the Portuguese corporations present their accounts in annual basis that, usually, coincides with the fiscal year and the time period of 'one year' in calendar year. Also, they can elaborate interim financial reporting (month, quarter or semester) that in anything affects the methodology developed in this paper. Also, the structure and information of the accounting information system must be subject to the following qualitative characteristics: relevance; objectivity; understanding; economic logic; accuracy; opportunity; quantification; trust; and verifiable. Indeed, the accounting information system must be free from material mistakes, frauds, omissions and of previous judgements, and it should be objective and impartial to the needs of the corporation. So, any information in the financial reporting allows influencing appropriately the evaluation of events of the past, making of decisions in the present and accomplishment the forecasts for the future (Peters et al. 2002). To accomplish all that, the authors propose the following seven tasks to build the model:

- 1st task - Establish the basic user requirements that must be communicated between the financial reporting analyst and the systems analyst, so that the evolution of the knowledge and experiences and achieve the conditions adapted to the progress.
- 2nd task - Establish the use-case model.
- 3rd task - Establish the interaction model.
- 4th task - Identify classes, attributes and operations.
- 5th task - Represent the relationships between classes.
- 6th task - Develop the open O-O architecture.
- 7th task - Improve other previous tasks and reapplied iteratively until the model is complete and accurate.

The goal of the O-O is to define all the classes, operations and attributes associated with them that are relevant for the financial reporting. It intends to develop the relationships between them and also to present the behaviour they exhibit (Pressman 2000). The basic user requirements must be communicated between the financial reporting analyst and the systems analyst; so that the

evolution of the knowledge and experiences allow obtaining the conditions adapted to the progress. Another question for the important relationship is that financial reporting must be concerned with meeting statutory requirements, record keeping, producing the financial statements and generate, in time, internal and external information that the corporation needs.

All systems present attributes group that are common to them (Vaassen 2002), and financial reporting is not an exception, it has to face the complexity of the problem domain. In a starting point of view, the structure of a complex system implies that is developed from a simple system that already works, for example a financial accounting (Booch 1994). But, the increase of reporting requirements is possible to change in any time each statement or introduce another one that must present. A full disclosure of the financial reporting presents notes to the financial statements, other issues, auditor's and management reports, and six financial statements, which are: balance sheet, income statement, functional income statement, origins and applications funds statement, current funds statement and cash-flows statement. These financial statements cannot be understood each one apart from the other. It is only by integrating them in an open architecture that the financial reporting can be evaluated.

In this paper, the notes to the financial statements or the annex of balance sheet and income statement are not object of reference, because this disclosure involves uncertainty, complexity and it is extensive in spite of being a summary of accounting policies and explanatory notes. So, the main objective of the paper is the six financial statements which provide all information to investor decide. So, it will be developed the *first task of the model* subdivided by the requirements and specifications of each financial statement.

The first financial statement analysed is the balance sheet (see Table 1). It is subdivided in gross assets (GV), depreciation and provisions (DP) and net assets (NV). The purpose of this statement is set out the financial position of the corporation. The horizontal format was adopted on the Portuguese POC, providing in the Fourth Directive of the European Economic Community (EEC 1978). The balance sheet represents a group of accounts which are objects, aggregated in sub-classes like fixed assets and current assets, and in classes equal to assets, equity and liabilities, which also reflect the patrimonial structure of the corporation, in a

specific period of time. The '*net result of the exercise*' is an object from the income statement.

Assets	**Value**			**Equity and Liabilities**	**Value**
	GV	**DP**	**NV**		
Fixed assets				**Equity**	
Intangible fixed assets …	X	X	X	Shareholders' equity ……..	X
Tangible fixed assets …..	X	X	X	Own shares ……	-X
Financial assets ……...	X	X	X	Reserves legal ……..……	X
Current assets				Reserves others ……..	X
Stocks ……	X	X	X	Transition results ……...	±X
Debtors – m/l term …….	X	X	X	*Net result of the exercise* ……...	±X
Debtors – s/ term ……	X	X	X	Dividends anticipated ……	-X
				Liabilities	
Marketable ……..	X	X	X	Provisions liabilities and charges …..	X
Cash and banks ……..	X		X	Creditors – m/l term ……..	X
				Creditors – s/ term ……	X
Accruals and deferrals....	X		X	**Accruals and deferrals** ……..	X
TOTAL	**X**	**X**	**X**	**TOTAL**	**X**

Table 1 Balance Sheet

The second financial statement analysed is the income statement (see Table 2). It collects, process and represents accounting information related with the activity of the corporation. The POC adopted the horizontal format in spite of the Fourth Directive of the EEC provide four different proposals. The main objective is to measure and report how much wealth (profit or loss) the business has generated during a specific period of time. Table 2 shows a group of income statement accounts which are objects, aggregated in sub-classes and classes that represent: inflows (revenues), outflows (costs), increase (gains) and decrease (losses) of different type of resources of the corporation. The nature of the business will determine a different model.

Costs and losses	**Value**
Operational costs and losses	X
(A)	X
Financial costs and losses	X
(C)	X
Extraordinary costs and losses	X
(E)	X
Income tax of the exercise	X
(G)	X
Net result of the exercise	±X

TOTAL	**X**
Revenues and gains	**Value**
Operational revenues and gains	X
(B)	X
Financial revenues and gains	X
(D)	X
Extraordinary revenues and gains	X
(F)	X
TOTAL	**X**
Summary:	
Operational results: (B) - (A)	X
Financial results: (D-B) - (C-A)	X
Current results: (D) - (C)	X
Results before tax: (F) - (E)	X
Net result of the exercise: (F) - (G)	X

Table 2 Income Statement (S_Income)

The third financial statement analysed is the functional income statement (see Table 3). It reflects the net result of the exercise or the earning per share as a result of the total revenue less the total costs incurred in generating the revenue in a specific corporation. It is possible to recognise revenue at different points in the chain production of the corporation (Atrill & McLaney 2004). Also, it identifies his application and it is useful to analyse the evolution of the corporation. This statement was regulated by the *Decreto-Lei* n.º 44/99 of February 12 (MF 1999). The '*net result of the exercise*' is an object from the income statement.

	Value
Sales and services ……...	X
Costs of sales and services ……	-X
Gross results	+X

Other operational revenues and gains ……	X
Distribution costs ……	-X
Administrative costs ……...	-X
Other operational costs and losses ……..	-X
Operational results	±X
Net cost of financing ……..	-X
Gains (losses) filial and associate ……..	±X
Gains (losses) in other investments ……	±X
Results no-usual or no- frequent ……	±X
Current results before tax	±X
Current results tax ……...	-X
Current results after tax	±X
Results of discontinued operations (net value) ……..	±X
Revenues and gains extraordinary ……..	X
Costs and losses extraordinary ……...	-X
Extraordinary results before tax	±X
Extraordinary results tax ……	-X
Extraordinary results after tax	±X
Changes in accounting polices (net value) ……	±X
Net result of the exercise	±X
Earnings per share	±X

Table 3 Functional Income Statement (S_Income_functional) (Magro et al. 1999)

The fourth financial statement analysed is the origins and applications funds statement (see Table 4). It is supported by the changes in the accounts presented in the balance sheet of two consecutives periods of time. This statement is structure in two separate parts: origins of funds that are the resources generated in the one of the exercise with relation to the other; and applications of funds that are financial resources used by the corporation in a specific exercise to develop the economic activity. The '*net result of the exercise*' is an object from the income statement.

Origins of funds	**Value**	**Applications of funds**	**Value**
Internal			
Net result of the exercise ……...	±X	Distribution:	
Depreciations (changes) ……	X	For application of results ……	X
Provisions (changes) …….	±X	For application of reserves …….	X
External			
Increase of shareholders' equity ……	X	Decrease of shareholders' equity …...	X
Decrease financial assets ……...	X	Increase financial assets …….	X
Decrease of debtors – m. /l. term …..	X	Increase of debtors – m. /l. term …….	X
Increase of creditors – m. /l. term ….	X	Decrease of creditors – m. /l. term ….	X
Decrease of fixed assets ……	X	Increase of fixed assets …….....	X
Decrease of current funds ……...	X	*Increase of current funds* …….	X
TOTAL	**X**	**TOTAL**	**X**

Table 4 Origins and Applications Funds Statement (S_O_A_Funds)

The fifth financial statement analysed is the current funds statement (see Table 5). It shows the changes in short term accounts of the balance sheet of two consecutives periods of time, but there are not included in the Table 4. The '*decrease of current funds*' or '*increase of current funds*' from Table 5 is included in Table 4. This procedure increases the complexity of this information system.

	Value		**Value**
Increase of stocks ……	X	Decrease of stocks ……	X
Increase of debtors – s/ term ……..	X	Decrease of debtors – s/ term ……..	X
Decrease of creditors – s/ term ……..	X	Increase of creditors – s/ term ……..	X
Increase of cash and banks ……	X	Decrease of cash and banks ……	X
Accruals and deferrals ……	X	Accruals and deferrals ……	X
Decrease of current funds ……..	X	*Increase of current funds* ……	X
TOTAL	**X**	**TOTAL**	**X**

Table 5 Current Funds Statement (S_Current_funds)

The sixth financial statement analysed is the cash flow statement (see Table 6). It is established by the Accounting Standards (*Directriz Contabilística*) n.º 14 of the Portuguese Accounting Standards Commission (CNC 1994). During a period of time, it presents all the cash movements with main objective of knowing the uses and sources of receivables and payments of the corporation. This ensures the identification of causes and effects in process decision and if they have the same effect from normal activity or extraordinary. It is the most complex financial statement.

Each one of the financial statement referred should not be viewed in any way as substitutes for others. Rather, they should be seen as performing different financial reporting functions. But, these statements represent the main requirements to the open architecture, knowing that will diverge according to the type of the business to which is made it. These features make an O-O approach easier to be configured for full supports of these aspects.

Direct Method	**Value**
Operational activity receivables	X
Operational activity payments	-X
Operational activity flow (1)	±X
Investment activity receivables	X
Investment activity payments	-X
Investment activity flow (2)	±X
Financing activity receivables	X
Financing activity payments	-X

Financing activity flow (3)	±X
Changes cash and cash equivalent (4) = (1) + (2) + (3)	-X
Exchange rate differences	±X
Cash and cash equivalent at start of period	-X
Cash and cash equivalent at end of period	X

Table 6 Cash Flow Statement (S_Cash_flow)

In the 60's starts the expansion of the use of computers (Ianman 1998), and consequently, the promotion of techniques and inherent procedures to any information system that become one of the essential tools of accounting. The interaction among financial reporting (that integrates financial accounting and corporate finance) and open O-O architecture pointed out to assure that the financial structure to the corporation, obtaining a financial management between needs and resources; to observe cash management of the corporation, studying the cycles of exploration of the corporation, to assure the liquidity, with the objective of not allowing, with permanence character, that profits and gains are smaller than expenses and losses; to allow constant solvency of the corporation, with special attention of the degree of liability of the capitals and the exigency period, volume and typology of the loans; to assure profitability of capitals and productivity of the corporation, maintaining the competitiveness in its activity sector; to obtain an appropriate process that allows taking, to evaluate and control the management decisions.

4. FROM THE FINANCIAL REPORTING TO AN OBJECT-ORIENTED ARCHITECTURE

In such complex system as financial reporting, there are issues that cannot be adequately modelled because they are qualitative unknown and un-revealed (Liu & Stewart 2004). Thus, it is important to generate consensus amongst the different groups or individuals that participate in this process, because the interaction of the O-O approach with the financial reporting is supported in accounting information generated by the economic activity of the corporation, which produce outputs of information and the construction of the financial statements. The O-O approach provides a generic means of recording business data, because it is more adaptable to change and economically feasible while the eXtensible Business Reporting Language (XBRL) aims to facilitate the automatic exchange of information between software applications that uses a set of taxonomies to provide a specific framework for data interchange according to existing reporting standards (Bonsón

2001). However, there is also the need to clearly the benefits to be derived from implementing O-O approach and XBRL solutions that will answer the information needs of the corporation (Williams et al. 2006). Thus, all the reports produced should be in XBRL format must have the integration of information.

However, in this task another dimension of complexity arises which concerns the interaction among the components of a software architecture. Software architecture is an abstract view of a software system distinct from the details of implementation, algorithms, and data representation (Dragoni & Gaspari 2005). In fact, the *second task of the design process* uses successfully a Use Case Diagram in the notation UML (see Figure 3).

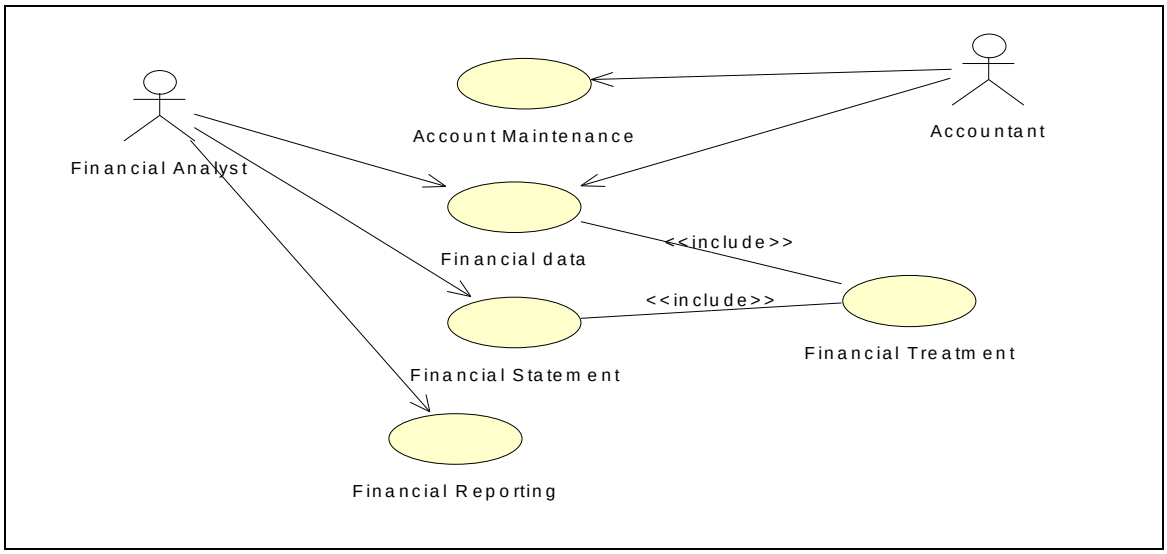

Figure 3 Use Case Model

The Figure 3 represents the development of the open architecture in the user perspective. Thus, this formal specification of the Use Case Diagram describes the requirements of the information system, defining the relationship among the different actors, that could not being necessarily humans. Also, they participate in the system to execute its functions through Use Cases. Each Use Case represents a sequence of actions in the system. Use cases, actors and systems are described using use case diagrams (UML 2004).

In the Figure 3, the systems analyst and the financial analyst are standing out as human actors that change the requirements of the system to the other built. In this development activity, they benefit from the accountability promoted by the accountant, where it stands out the account maintenance, the financial data and the financial treatment, allowing to generate the financial statements and the

consequent financial reporting. In the financial statements, they include control objects to give the required control flows between the capabilities of role objects in order to satisfy the collaborative rules defined in the commitment model (Lin & Lin 2004).

The *third task of the design process* settles down the interaction model (see Figure 4), in which comes the Sequence Diagram that describes as they are integrated the different objects in a certain period of time and in that each object links with the other ones through the change of messages, following the Sequence Diagram of 'Account Maintenance'.

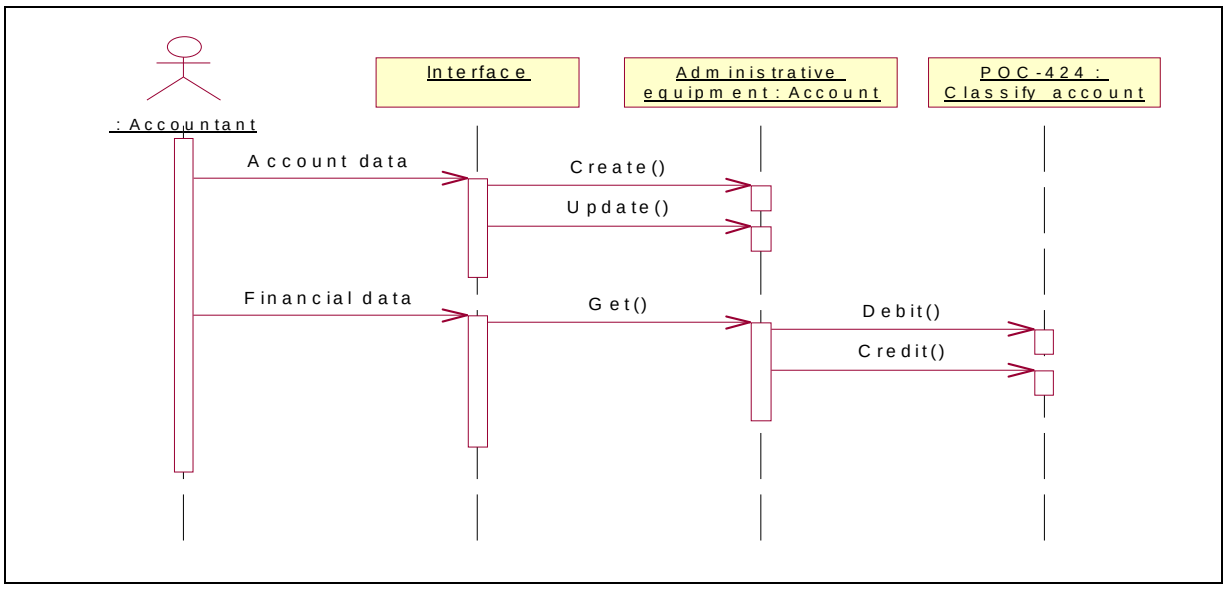

Figure 4 Interaction Model: Account Maintenance Sequence Diagram

This interaction model is only one of the examples of the system. In the interaction model that represent an Account Maintenance Sequence Diagram show in Figure 4, the accountant as an human actor manage the accounting and financial data (i.e. Administrative equipment) following through the specifications of the POC requirements that generate the financial accounting. The specifications of the Portuguese standards are according with the International Accounting Standards and International Financial Reporting Standards (IAS/IFRS) in agreement with the Regulation (EC) nº 1606/2002 of the European Parliament and of the Council of 19 July 2002 on the application of international accounting standards (EC 2002).

The *fourth task of the design process* is the identification of classes, attributes and operations in the financial reporting. The semantic definition of each class makes it a textual description. Also, recognizes sceneries where it participates and

all the attributes and operations are described (Fonseca & Silveira 2002) in relation to present research, but for reasons of synthesis are not identify. Therefore, the main objective of this task is to describe one example show in Figure 5 and that represents the assets class. The finite numbers of operations or attributes are related with the class.

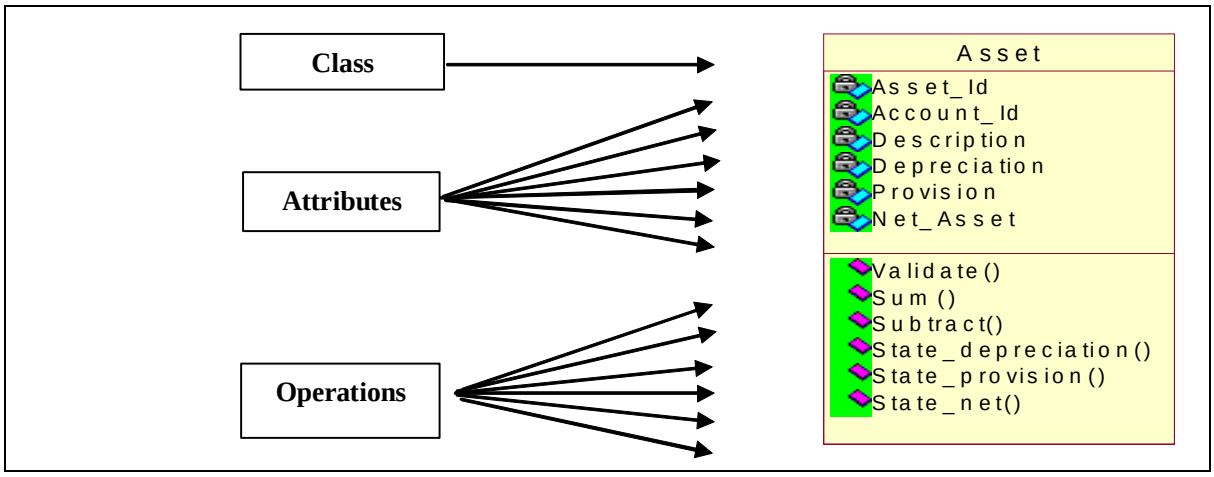

Figure 5 Asset Class, Attributes and Operations

The *fifth task of the design process* promotes the representation of the relationships between classes (Figure 6). It is exemplified, in the Figure 6, for the assets and the Balance Sheet. The inheritance concept is used to define object hierarchies and abstract objects allow the writing of generic algorithms and the easy extension of the existing code and this capability of the O-O applications to interpret the same request differently depending on the object being processed is called polymorphism (Kromer et al. 2005).

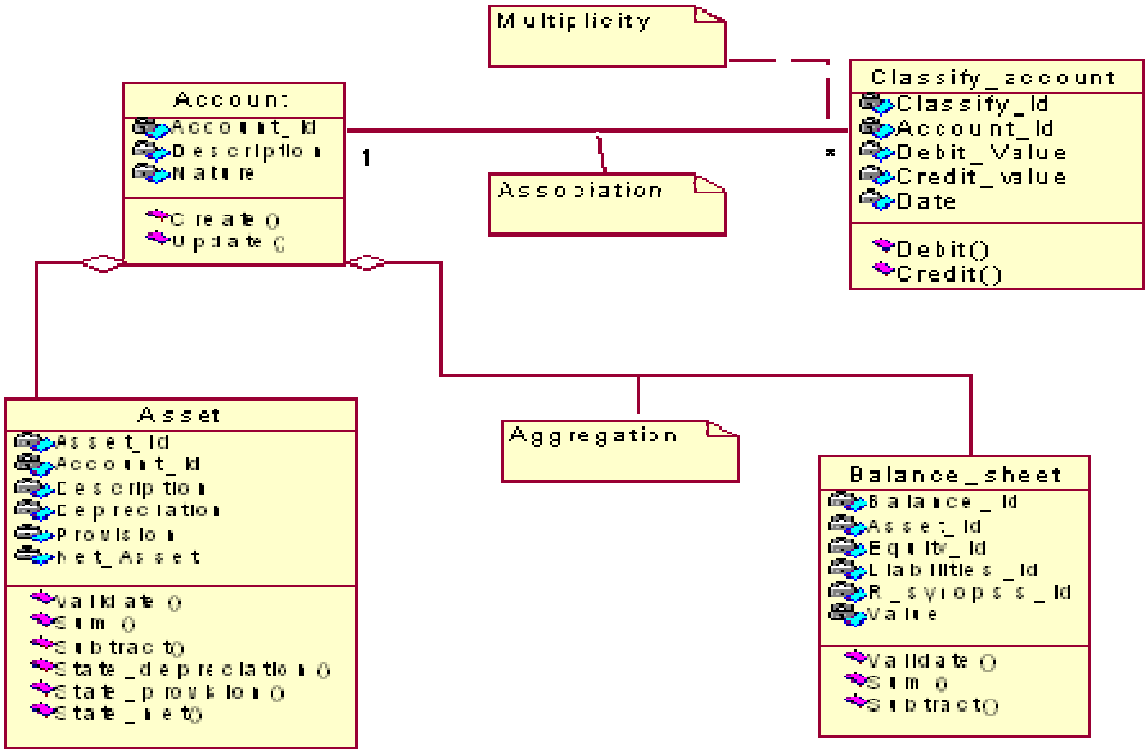

Figure 6 Relationships between Classes

After the definition of the scenarios and the identification of the classes, attributes, operations and its relationships, it was obtained the architecture requested by the O-O approach. The *sixth task of the design process* establishes the Class Diagram (see Figure 7). Open O-O architecture enables the systems analyst or the software engineer to model a problem by representing both static and dynamic characteristics of classes and their relationships. The approach reflected in the Figure 7 is valid for individual and consolidated financial statements, knowing that both financial statements must draw up on the basis of standards applied both.

The interactions between individual and consolidated accounts can be represented in a new task. Analysis for O-O systems occurs at many different levels of abstraction. In this sense, by studying the interaction of the O-O with the financial reporting analysis, using the effect of the information of the circuit documental resultant of the regular activity of the corporation, it expresses in the financial accounting, originating outputs of information accounting translated in the construction of the financial statements.

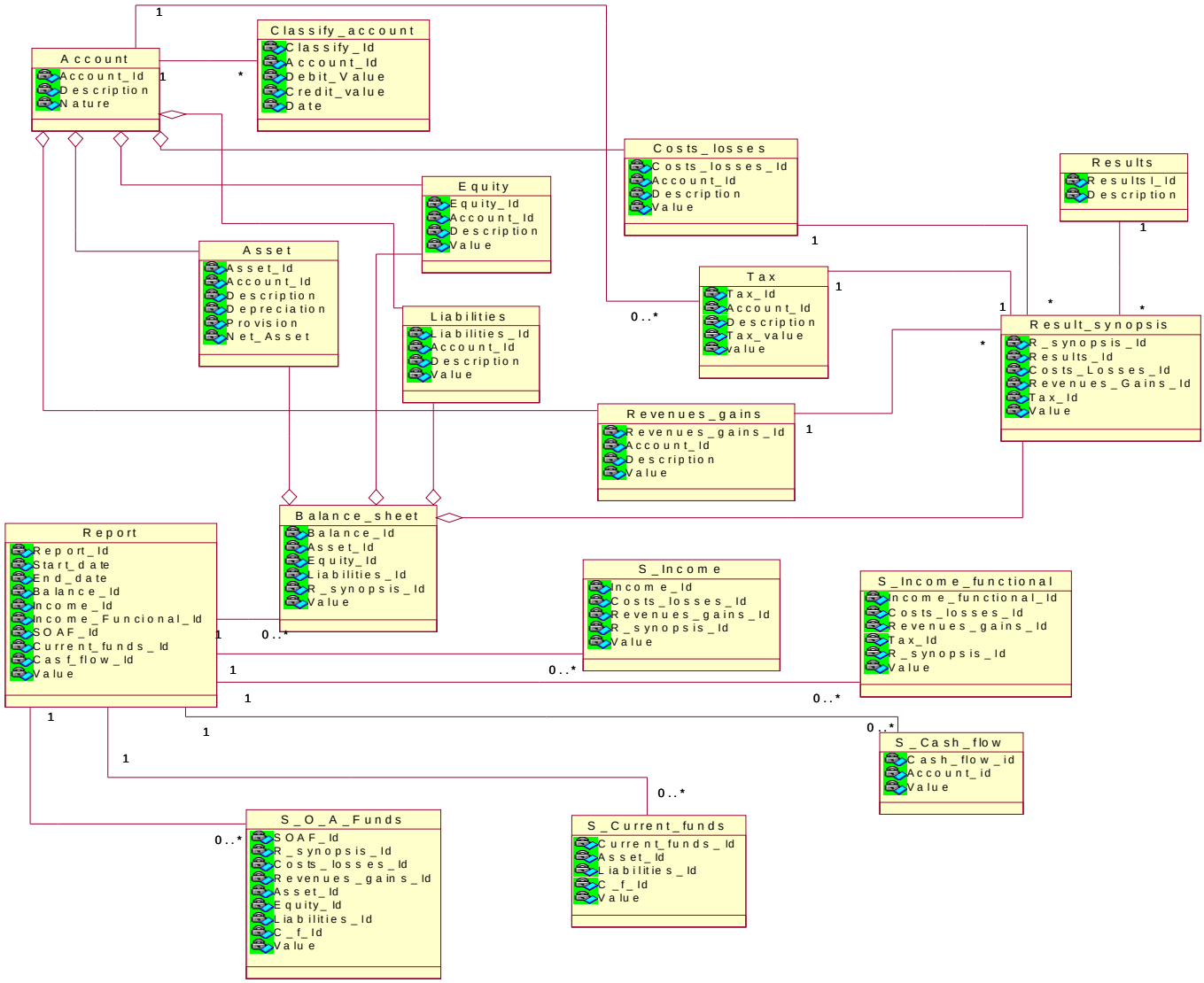

Figure 7 The Open O-O Architecture

Consequently, the authors use the O-O approach to create a software system that is adaptable to changes. It was developed with an economic expression and obtaining a level of larger trust in relation to the correct system. It is expected, like this, to decrease inherent expenses in the development of complex software systems, as inherent in the economic and financial analysis.

It becomes necessary to improve the open O-O architecture with all the previous tasks reapplied iteratively until the model is complete and this will confer high flexibility and adaptability to the software design.

The proposal model presented in Figure 7 is a prerequisite for assimilation of engineering principles into software development (Jackson et al. 1995). The main advantages of the O-O approach for financial reporting is the similar name of classes and attributes (see Figure 7), as well as, the names of the six financial statements. Although, the open O-O architecture provides requirements specification for this system development still contains precise, formal and easily understood components from the financial reporting.

5. DISCUSSION

The purpose of this paper is to develop an O-O approach as an open architecture for financial reporting. Emphasis was place in the O-O approach that offers a new and powerful method for software engineering, because it is easier to use and to develop in order to produce software more understandable and maintainable. In this sense, it contains all the characteristics of a complex organized system and it is available for constant improvements and changes. This is possible because the seven tasks following in the creation of the O-O approach for financial reporting used a spiral model with constants refinements. In addition, it allows anyone to make use of this proposal, because as an open architecture is available to any corporation to apply it. Several authors have encouraged software engineers to build reusable components, although there is little information in the environmental literature about how these will be develop or use (Papajorgji et al. 2004) and one advantage is act as an effective member of a team involved in analysis using an O-O approach. In the Portuguese environment of the financial reporting, it appears that the relative simplicity of the selected model does not affect the nature of problems encountered and the provided solutions.

In the analysis and conception of O-O approach, the main excellence measure is the simplicity and use easiness, allowing to obtain an effective and efficient architecture, improving the maintenance, reutilization and modification of the software. These benefits are essential for the financial reporting in consequence of regular adaptation needs to the legal environment and economic changes. Another advantage of the O-O approach is the development to environments with business view.

The financial statements provide information essential to the decision process based in the economic and financial situation of the corporation and its changes, as

well as the management process. So, all the system is being useful to many stakeholders, such as shareholders, decision markets, investors, workers, creditors, banks, public administration, stock market, clients, and other users of the information). This analysis is modified to each corporation according to the typology and the financial analyst's objectives, the knowledge of the corporation and its historical background, economic sector, social and international environment. For all these reasons, it is crucial to have multidisciplinary teams, especially concerned with elimination of asymmetric information between the financial analyst and the systems analyst that could reproduce the reality and develop a system that it is better adjusted at the level of information demanded by the stakeholders.

Globally, the authors agree with Formica (2003) that satisfiability, i.e. the absence of contradictions independently of any database, it is a fundamental and critical problem that has been marginally referred in the literature. This is one way to promote discussion of these results, to develop software programmes and to allow new technologies to incorporate in business decision and in financial reporting. An issue for further research is that the O-O approach speeds up the development of new programs, and, if properly used, improves the maintenance, reusability, and modifiability of software.

Particular emphasis is given to the UML that is quite adapted for the construction of models of information systems of O-O, half constituting in this case an excellent one, jointly with the easy accessibility of the Rational Rose tool for non programmers, being adaptive, largely used and developed with robustness, constituting an efficient solution to model. Thus, it was sought, in the analysis of the financial reporting, to identify objects and classes in particular common to this problem. If on one side, the information, expressed in the financial statements, shows all the events of the past, the same assumes, more and more, a primordial paper when being used for planning the future.

Thus, this paper is pioneering in the study of the relation between the Object-Oriented approach and the financial reporting, as well as in providing the reader with a perspective on this important field, the financial report, and has left some questions open for discussion, leading possibly to another improved study which could provide solutions to these questions. In a future research the authors want to

improve the model, including the notes to the financial statements and their relationships.

This open O-O architecture recognises that any actions which a corporation undertakes will have a direct and indirect cause and effect not just upon the corporation itself but also upon in their external environment. This view places financial reporting at the centre of the information system. To deal more efficiently with theses complex aspects, it has been accepted the significant features and benefits of the O-O approach.

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