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USING INTELLIGENT TECHNOLOGIES FOR IMPROVING DECISIONAL PROCESSES

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Abstract

The management of organizations in a competition driven environment requires the processing and use of a significant amount of information and knowledge. The intensification of the business environment has its influence as well, so that, the process of adopting the best possible decision, capable of granting utter success by obtaining high performances becomes a difficult challenge to undertake.

From the perspective of the purpose of accounting for a performing management we can see that organizations need informational systems capable of analyzing huge amounts of information and knowledge, to be able to quickly process them and to offer relevant results for all user categories. In our opinion the most adequate solution to fixing this issue is provided by intelligent technologies.

This is why we identify the opportunities than intelligent technologies have to offer for accounting and we demonstrate the applicability of the multiagent systems in this field. The motivation of this research is due to the limitation and deficiencies of the present accounting informational systems, which are briefly described in our paper and we establish the advantages of using multiagent systems in the field of accounting.

For these reasons, we are stating that multiagent systems need to be quickly implemented in the accounting systems that are facing huge challenges due to the expansion of Internet and Web technologies which force them to get adapted as they go to the modern trends in the development of present informational systems.

The present paper is the result of a scientific research situated at the edge between accounting, informatics and economical and financial analysis. It contains theoretical approaches and careful debates on the fragile aspects of intelligent systems, but also a practical approach of the field, offering new proposals for the development and the implementation of a multiagent system in order to find and use financial and accounting information on the Internet.

By setting up a multiagent system designed for the research and processing of financial and accounting information, we are focusing the benefices of using intelligent technologies and it also opens a new way, which refers to the implementation of intelligent systems in accounting. The objective of the multiagent system that we created consists in finding a pertinent solution to a global problem or to control complex accounting systems. Each agent in the structure of the system has its own abilities and knowledge and must interact with other agents in order to solve complex problems, to dodge potential conflicts or to acquire and to share accounting knowledge.

Of course, due to the present financial crisis, it is an expected fact that multiagent systems are a solution to be considered being more than welcomed due to the fact that it generates income and it opens new opportunities for the organizations that adopt it.

Keywords: Intelligent financial-accounting information system, multiagent system, agents
JEL classification: O31, O33, Q55

1. INTRODUCTION

In contemporary economy, accounting is a must, not a desire. In an un-precedent ample fiscal world, the accounting offers solutions for the development and activity reflection of any company: no matter the structure of its capital, the domain or the country. Accounting is, in a certain way, a science without frontiers, and, practically, one cannot conceive economic activity without accounting.

In the context of economic globalization, of increased competitiveness, of impose of new and better qualitative demands or of adaptation to new accounting standards, a new approach to the information system of the company is necessary. Thus, the classic accountant is about to be replaced with the professional „worker with accounting information”, who knows how to use the domain’s technologies. The need for pure, correct and significant information has become a must for all the departments of a company and, definitely, more than ever a must for the financial-accounting department, especially when we search for profitable solutions for the firm.

Moreover, the informational volume and dynamics that surround the financial and accounting activity of a company, as well as the rapid Internet expansion transform this „worker with accounting information” into an agent or an accounting informatics system that is adapted and projected according to the demands of new informational technologies. Practically, we consider that an organization cannot survive and is not able to make the best decisions unless it succeeds in keeping up with the actual tendency of accounting informatics. Moreover, it is more and more necessary to have intelligent systems that should assist the accountant, that should offer him useful information at the proper moment and that, why not, should prepare a decision in his place. In our opinion, the fulfilment of this objective is possible through the projection and the implementation of a multiagent system specific for accounting.

The struggles to develop the accounting practices are necessary, especially in Romania, where these activities are consolidating simultaneously with the integration process of the Romanian economy in European Union's structures.

Intelligent agents represent a new and interesting frontier of artificial intelligence, which offers unthinkable perspectives for the development of applications in the accounting field. The technology of the systems based on agents has imposed as a paradigm for the conceptualization, projection and implementation of software systems. Agents represent software programs that act independently in open and dynamic environments in order to solve an ever bigger number of complex problems. The complexity of the applications calls for more and more agents that should communicate and collaborate for the solving of the problems.

A multiagent system represents a network of software agents that interact to solve those problems that go beyond the capacities or the individual knowledge of each member. Generally, multiagent systems are informatics systems in which semi-automatic entities interact or collaborate in order to complete a set of tasks or to fulfil their objectives. The dynamic and open environments need agents that can be homogeneous or heterogeneous, with common or different objectives. The projection, the implementation and the evaluation of multiagent systems can raise different specific issues, such as the coordination strategies or the negotiation mechanisms and techniques for detecting the conflict situations. The specific issues for solving conflicts and coordinating the agents` actions have called the attention of the researchers in the domain of distributed artificial intelligence, as well as in the domain of solving certain problems that call for collaboration concerning the developing of the financial-accounting applications.

Recently, the number of applicability domains for the agent-based technology has increased considerably due to the benefits they can offer. This increase demonstrates not only the potential of the agent paradigm over the society and human life, but also the fact that agent-based technology will play an ever more important role in economy and informational society.

Nowadays, we can notice that the vision of the two authors has become real: ontology's, agent-based systems and their combinations are more and more often used in order to share the knowledge both within and outside of an organization. The technology of multiagent systems is nowadays considered to be - by both theorists and practicing in many domains – one of the most adequate paradigms for the mediation between the heterogeneity of the applications that work in open and distributed systems.

Due to changes in the software conceiving and production, the paradigm of multiagent systems has become one of the most important technologies used in nowadays` accounting informatics. Moreover, as a result of our research, we have concluded that this change can be referred to as a „revolution", since it entangles important conceptual modifications in the projection of the systems and, implicitly, in their properties:

- the application components act in an environment, they can influence it and be influenced by it;
- software systems are the main subject of decentralized management and they can modify their structure in a dynamic way;
- system components represent autonomous and reactive control unities that interact according to local models.

The boom of modern informational technologies has led organizations to look for other means of running their own businesses. This rapid development has emphasized the beginning of a new class of systems: the informational systems for business processes. Thus, we can notice an ever intense preoccupation for ensuring the interoperability of the systems, so that organizations can interact in order to offer a varied range of services and products to all those who are interested.

The new informational systems are often distributed, open, heterogeneous and dynamic. Thus, the researchers` attention has been caught by multiagent systems, with the aim of modelling these complex systems distributed as a set of software agents that interact in a common environment. The decomposition of a system in a number of agents will allow it to react and to better adapt to the changes in the execution environment.

2. MULTIAGENT SYSTEMS

Simultaneously with the development of the technology and the increase of the complexity of applications, it is necessary to use systems formed of more agents that should work together and communicate in order to fulfil complex tasks. These agent architectures form multiagent systems.

Ever since their appearance, the research of multiagent systems has targeted the behaviour and the projection of the architecture of independent intelligent agents as well as the way in which they should interact. In this context, the researcher M. Rahwan defines a multiagent system as it follows: a network distributed by agents that work together in order to fulfil some complex tasks which could not be fulfilled individually by any agent from a multiagent system [Rahwan, 2005].

Multiagent systems offer several advantages if compared with one agent systems. According to [Weyns, Holvoet, 2006, p.76], the most important advantages are:

efficiency – a multiagent system allows parallel and nonsynchronic processing; the tasks can be decomposed in independent ones and simultaneously processed by more agents. For instance, the multiagent system projected by us (MyAgents) includes three agents: each one of them fulfils independent tasks and the whole system has the objective of collecting and on line processing the financial accounting information;

resistance – if the responsibility of the tasks is shared between more agents, the system can tolerate errors: if it is formed of one agent, should there be a tension fall, the whole system falls. Although multiagent systems do not necessarily have to be implemented onto more processors, in order to better resist failures, the agents that form the system should be distributed onto more computers;scalability –multiagent systems are more flexible and scalable than one-agent systems. As a result of the modular approach of multiagent systems, new agents can be introduced easily and at any time in the system in order to add new functionalities to the system [Sudeikat, Renz, 2006]; basic programming – the modularity of these systems makes their programming easier and favours a better control of the programming process. Instead of a single centralized agent that should fulfil all the tasks, the programmers are able to identify different subtasks and then control them through different agents of the system [Sudeikat, Renz, 2007b, p.300].

Multiagent systems develop and better the architectures based on one agent with an infrastructure for interaction and communication. Ideally speaking, multiagent systems extend the following characteristics:

- they are open systems and do not have centralized projection;

- they contain autonomous, heterogeneous and distributed agents that have different „personalities" (cooperation, selfishness, sincerity);
- they offer an infrastructure that enables the specification of communication and interaction protocols.

The agents of a multiagent system coordinate themselves through exchanges of services and information in order to be able to negotiate and accept engagements, but also in order to undertake other complex actions. That is why coordination and communication are extremely important characteristics for multiagent systems, whereas the same things are not so important for one-agent systems. In the case of these systems, the agents have to be able to identify one another, to list their possible actions and to formulate questions or give answers. Moreover, their infrastructure has to ensure protection services in order not to disturb agents` activity.

A multiagent system contains different agents that interact by initializing some communication actions. The agents act in a certain environment and they have different spheres of influence, namely they will have control over – or at least will be able to influence – different parts of this environment. These spheres of influence can coincide in certain situations; in that case, the dependence relations between them shall increase. In addition, the agents can be connected through other types of relations (for instance, the „subordination" relation when an agent is situated on a superior level compared to another agent).

According to the domain theory, a multiagent system is a network of entities that are capable to solve different problems, with different degrees of difficulty and complexity and that are able to collaborate in order to find answers to problems that surpass the capacity and the individual knowledge of every entity. Thus, the agents will coordinate their actions and have to be able to communicate the appropriate information or knowledge. In addition, there are constraints, in the sense that the agents cannot know at any moment everything about how other agents perceive the environment in which they act [Panait, Luke, 2005, p.405].

In conclusion, the term of multiagent system is used to define all types of systems with multiple autonomous components, called agents, that have the following characteristics:

- they share a common environment;
- they interact between themselves or with the environment in which they act;
- they have the capacity to partially solve a problem;
- there is not any global control system;
- the data are not centralized;
- the processing is nonsynchronic.

3. MAIN CHARACTERISTICS OF MYAGENTS MULTIAGENT SYSTEM

MyAgents is a multi-agent system conceived to analyze the financial-accounting indicators; it is mainly recommended for those organizations or institutions whose object of activity is offering financial consulting.

MyAgents is conceived as a client-server type of system, which means that it can be accessed and used by several users from different places simultaneously; moreover, the data operated by each user can be immediately accessed and used by the other ones.

The system was conceived in such a way as to enable the user:

- to analyze the financial-accounting indicators which are relevant for the activity of the company. The user can analyze the activity of one or more companies over one or more years;

- to have access to information about the companies from the database (the domain of activity, the identification data, etc);
- to have access to the indicators from the financial situations of the administrated companies, according to the specified year;
- to easily add o new financial situation for both a company already registered in the database and a new company.

Functional architecture of MyAgents system

The architecture of MyAgents system is presented in figure no. 1. From a practical point of view, the system's functionality is ensured by three software agents who communicate with the user by means of MyAgents graphical interface in order to fulfil the established objectives.

As one can notice, the three agents communicate with the user or intercommunicate and are responsible for the following:

- DataReadingAgent – registers the user's demands (by means of the graphical interface), collects the necessary data from the database and transmits them to AnalysisAgent;
- AnalysisAgent – is the main agent of this multi-agent system – it collects from the DataReadingAgent the data that are necessary for the analysis process; it calculates the values of the financial indicators and it establishes the ranges for the value of an element from the financial situation, value which will guarantee a better situation for the company. After finishing all these operations, this agent sends the results to ResultListingAgent;
- ResultListingAgent – it receives the results of the financial analyses from the AnalysisAgent and transmits them to the user either in text format (it creates a Word document and lists the results in it), or in Excel chart format.

4. THE DESIGNING OF MYAGENTS SYSTEM

In this paragraph, we shall give details concerning the conceiving of MyAgents system. Thus, we shall describe the main characteristics of UseCase diagram, the Class diagram as well as the Activity diagram (diagrams specific to the conceiving methodology oriented to UML object).

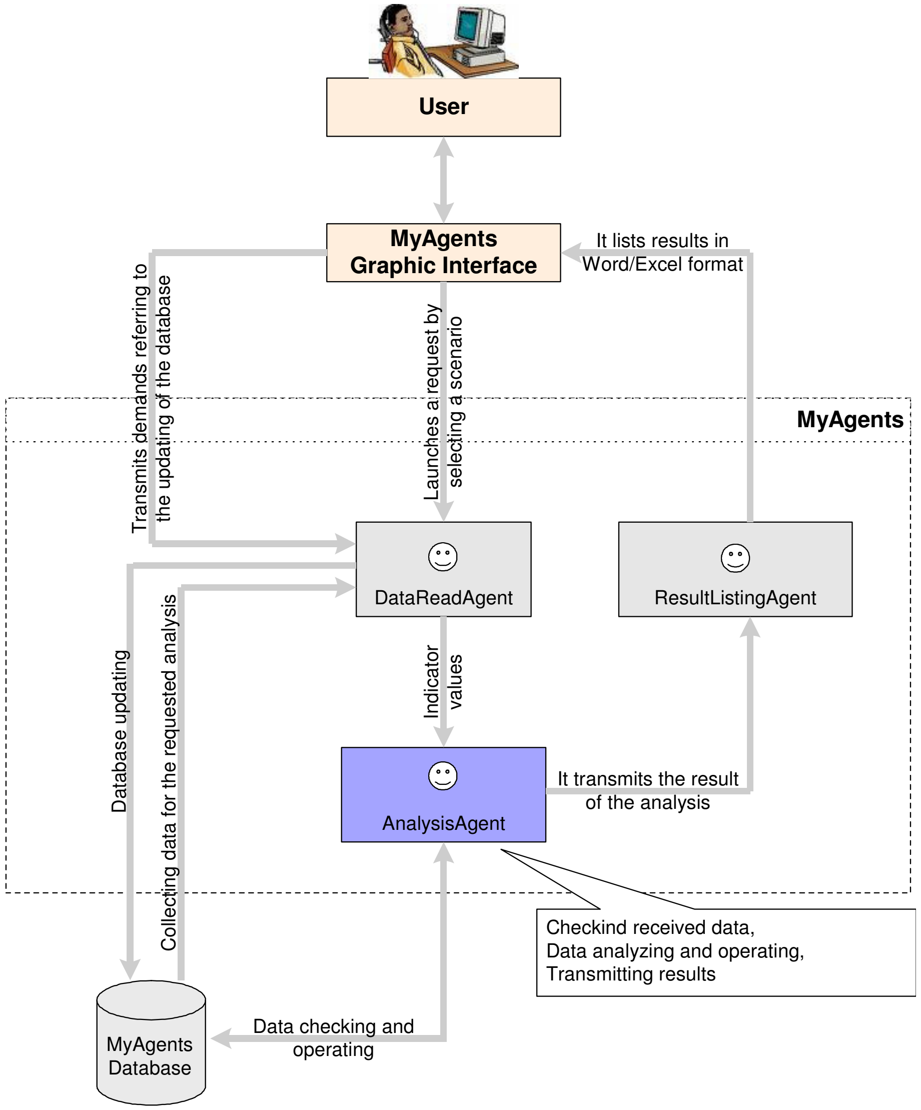

User
MyAgents Graphic Interface
It lists results in Word/Excel format
Transmits demands referring to the updating of the database
Launches a request by selecting a scenario
MyAgents
DataReadAgent
ResultListingAgent
Database updating
Collecting data for the requested analysis
Indicator values
AnalysisAgent
It transmits the result of the analysis
Checkind received data,
Data analyzing and operating,
Transmitting results
Data checking and operating
MyAgents Database

Figure no. 1 Functional architecture of MyAgents system

4.1. UseCase Diagram

The UseCase Diagram describes the system behaviour and offers an overall image over the way it is used from the point of view of the user [Oprea et al., 2006, p.402].

The actors implied in the use case are the three agents shown in figure no. 1 and the user; the meaning of the usecase is the following:

- authentification – it refers to the authentification of the users that want to have access to the system;
- checking ID and password – authentification supposes the checking of the name of the user and of his or her password;
- interface access – is the usecase that emphasizes the use of the application by means of accessing the graphical interface of the system. The extend dependency between the usecases authentification and interface access indicates the fact that only the authentified users can use the application. The extend dependencies that associate this usecase with other usecases such as collecting user data, data visualization and usecase choosing specify the options available for the user by means of MyAgents interface;
- collecting user data – enables the updating of the database if one wants to add new data (domain, company or financial situation);
- checking data correctness – each time data are collected by means of the graphical interface, the system checks their correctness. The database updating takes place only when the data introduced by the user are in accordance with the requested specifications, which mean that the database no updating is possible. That is why the usecases collecting user data and database updating are linked by means of the extend dependency relation. The associating of the user with the usecase database updating models situations in which either the modification of the data from the database or their clearing is desired;
- database updating – it realizes the updating of the database;
- usecase choosing – it models the situation in which the user chooses a usecase by means of the graphical interface;
- scenario analysis – the main actor for this usecase is DataReadingAgent which extracts the necessary data for meeting the request specified through the selected usecase (use case extracting data from the database);
- send scenario parameters – is the usecase that models the transmission of the extracted data to the agent responsible for the analysis of the indicators;
- parameter analysis – it analyzes the parameters received by the AnalysisAgent;
- calculating indicators – it refers to the calculation of the indicators specific to the usecase;
- result listing – it models the data transmission to the agent responsible for their listing;
- creating output format – it emphasizes the data in Word format or in graphical representations;
- result transmission – it models the result transmission to the user by means of MyAgents graphical interface.

4.2. Class Diagram

Class Diagram is considered to be the most important in the whole object orientation approach [Georgescu, 2002, p.174] and it presents the classes of a system as well as the relations between them (association, generalization and composition). The Class Diagram specific to MyAgents system and it includes the following classes:

- company – it administrates the companies in the database; the method company_updating() enables the database updating through adding or clearing of a company, as well as the modification of the data referring to an already existing company;
- headquarters – it administrates data referring to the headquarters of a company (department, city, street and street number). All these class attributes are public, because the objects of this class are generated through the method Company_updating() from the company class;
- domain_of_activity – it includes the companies domains of activity;
- financial_ document – the objects of this class are the financial situations of a company, i.e. the balance sheet, the profit or loss account;
- indicators – this is the class whose objects are the indicators of the financial documents;
- are – it is a class type-like association, its objects being given by the values of a company's indicators for the specified year;
- app_agents – this is the class that includes the most important methods of the system;
- connection() – it enables the connection of a user to the server where the application is;
- disconnection() – it enables the disconnection of a user;
- failure_connection – it supervises the connection of the user to the server and sends out error messages when the connection does not take place;
- SQL execution – this is the method through which a SQL instruction is operated (insert, clear, etc.);
- about – this is the method that offers additional information on the application or on the options of the menus;
- abandonment – it enables abandoning an operation from any point of an application;
- receive_message – this method enables an agent to receive the message sent by another agent;
- send_message – it enables the sending of a message from one agent to another. The last two methods are those that enable the communication between the system's agents;
- message_translation – it translates the message sent by an agent;
- command_execution – it executes the command transmitted through a message;
- form_generator – it generates forms by means of which the communication between the user and the MyAgents system is possible;
- DataReadingAgent – the methods of this class (read_the_scenario() and read_the_data_in_DB) are meant to receive the user's request (which is represented by selecting a scenario) and to extract from the database the data necessary to the AnalysisAgent in order to meet the request;
- AnalysisAgent – it includes the Execute_Analysis() method - the aim of which is to calculate the values of the indicators by using data transmitted by DataReadingAgent;

- ResultListingAgent – it includes the methods Generate_Word_Report and Generate_ Excel _Report () that enable generating the data received from the AnalysisAgent in Word format or in Excel chart format.

This is the structure of the message sent by the DataReadingAgent to the AnalysisAgent when one wants the indicators` analysis according to scenario 1 (the analysis of one company over one year):

- com-and_string=[SENDER=DataReadingAgent;COMMAND=EXECUTE_ANALYSIS _1;PARAM_NO=3;VALUE1=]+(_VALUE_B9)+[;VALUE2=]+(_VALUE_B5)+[;VALUE3=]+ (_VALUE_B34)

Should one want the analysis to be made according to scenario 3 (the analysis of several companies over one year), the command string would be:

- com-mand_string=[SENDER=DataReadingAgent;COMMAND=EXECUTE_ANALYS IS_3; NUMBER _OF_COMPANIES =]+(NUMBER_OF_COMPANIES)
- The command string has the following meaning:
- SENDER represents the agent that sends a message (in this case, the one that sends the message is DataReadingAgent);
- COMMAND refers to the command the agent that receives the message shall execute (EXECUTE_THE_ANALYSIS_1 means for the AnalysisAgent that it has to execute the analysis specific to scenario 1 and EXECUTE_THE_ANALYSIS_3 refers to the fact that the analysis is executed according to scenario 3);
- PARAM_NO informs the agent that receives the message about the number of parameters of the command (the parameters refer to the indicators whose data shall be used);
- VALUE1, VALUE2, VALUE3 represent the number of the indicators analysed according to the selected scenario;
- VALUE_B5, VALUE_B9 and VALUE_B34 represent the indicators whose values shall be used. B5, B9 and B34 represent codified values and refer to an indicator specific to the balance sheet (B) in the position 5, 9, respectively 34 (for example, B5 is the indicator Stocks from Balance Sheet and it is used by the AnalysisAgent when it calculates the indicator of the immediate cash). CPP01 is a codified value used in another message and it refers to position 1 from Profit and loss account (Turnover);
- NUMBER_OF_COMPANIES is the parameter through which the number of the companies selected by the user is sent in order to be analyzed.

The method that enables for this command string to reach the destination agent is the following:

- Send_message (2,command_string)

As you can notice, the method has two parameters:

- 2 is the agent to which the message is sent (2 is the AnalysisAgent);
- command_string – the command string that was sent.

4.3. Activity Diagram

The Activity Diagram describes the continuity of the internal workflows determined by implicit actions of the system.

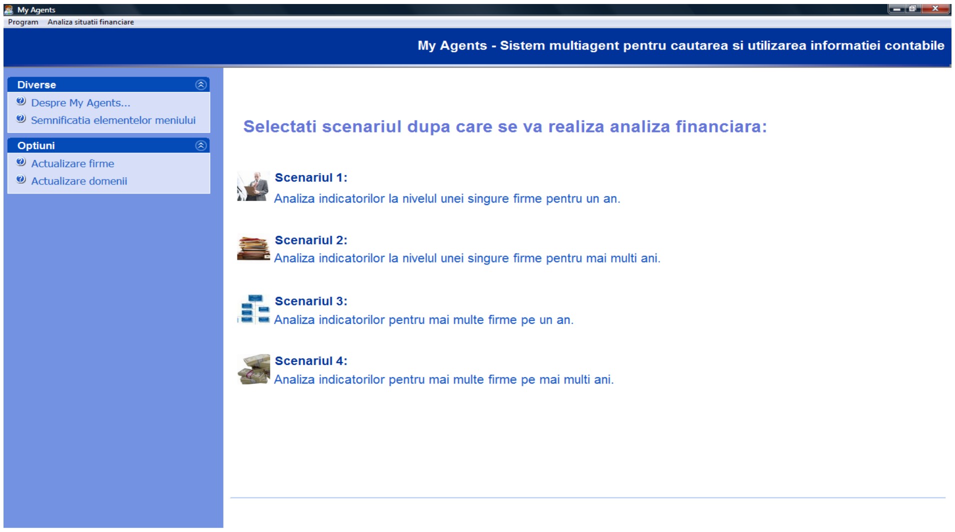
In order to access and use the graphical interface of the application, the user has to authentify. If the ID or the password is invalid, the system does not allow accessing the application; in this case the user can either enter once again the authentification data, or abandon the application (abandoning the application can be made by pressing the Exit button or by accessing the option on the main menu). If the authentification data are validated by MyAgents system, the user can have access to any option through the graphical interface.

As one can infer from the Activity Diagram, the user can handle two major operations through the graphical interface: he can visualize different data from the database (companies, domains or financial situations for different years) and update them if necessary, or choose one of the scenarios in order to analyze the financial-accounting indicators.

In this context, we can say that this system is flexible; it enables the user to abandon the current action from any point of the application. Thus, if the user changes his mind, he will no longer have to go through all the steps specific to the selected action and only after having finished this should be able to reverse to a window that should allow him to select another option.

5. THE USE OF MYAGENTS SYSTEM

In order to use this application, the user has to authentify by introducing the user name and the password. After the authentification, the main interface of the application is accessed (figure no. 2).



My Agents - Sistem multiagent pentru cautarea si utilizarea informatiei contabile

Selectati scenariul dupa care se va realiza analiza financiara:

Scenariul 1:
Analiza indicatorilor la nivelul unei singure firme pentru un an.

Scenariul 2:
Analiza indicatorilor la nivelul unei singure firme pentru mai multi ani.

Scenariul 3:
Analiza indicatorilor pentru mai multe firme pe un an.

Scenariul 4:
Analiza indicatorilor pentru mai multe firme pe mai multi ani.

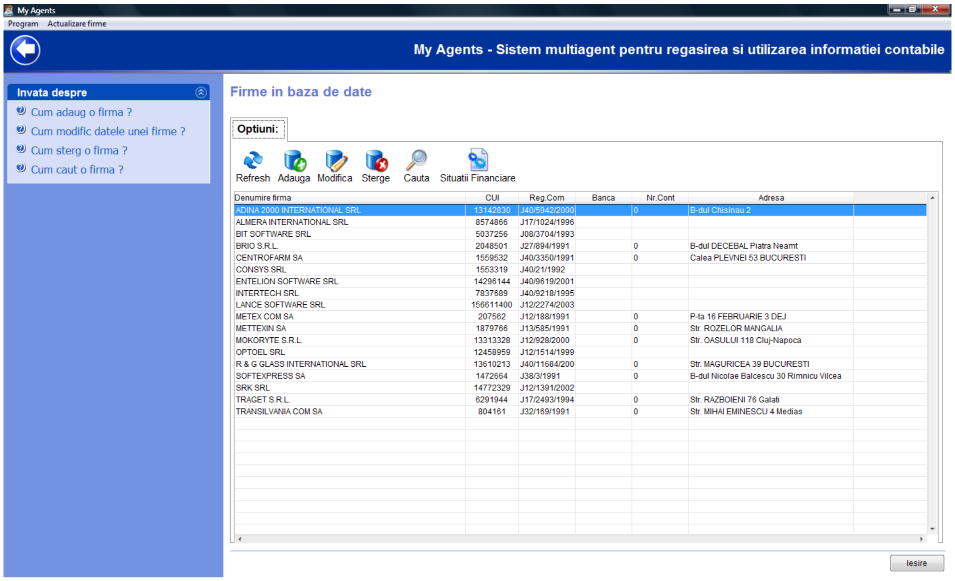
Figure no. 2 The main interface of *MyAgents* system

As we can notice in *figure no. 2*, *MyAgents* system have a main menu formed of two options:

- ❑ *Program* – which includes:
  - *About* option – offers the user general information about *MyAgents* system;
  - *Refresh* option – refreshes the main window and updates the database, so that all online users can find out the possible changes made over it;
  - *Back* option – allows going back to the previous window (the user can also use the key combination *Ctrl+BACKSPACE*);
  - *Main menu* option – offers the possibility to go back to the main interface from any zone of the program;
  - *Deconnect* option – through it, the user can disconnect from the application;
  - *Exit* option – allows exiting the application.
- ❑ *Financial situation analysis* – allows choosing a script for the financial-accounting analyses.

A second menu (formed of two options, too) is available on the left of the main window and it includes:

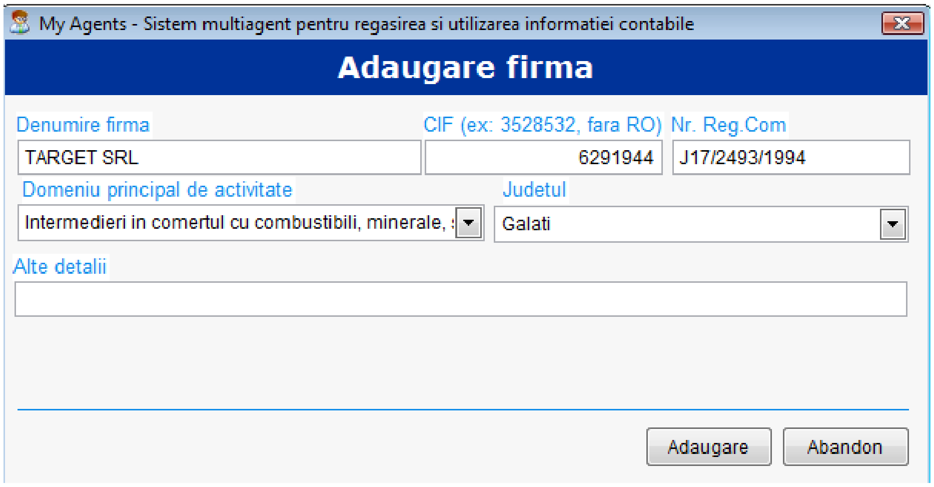
- *Various* – offers information about *MyAgents* system or about the significance of the analysed scripts;
- *Options* – used to allow the modification of the content of the database by updating the firms, the domains of activity or by adding new financial situations specific to the registered firms. If one wants to add a firm to the database, the user has to access the *Updating firm's* option. As we can notice in *figure no. 3*, the user has all the information at his disposal (through the menu *Learn about*), namely information about the way in which a firm can be added to the database, about how data can be deleted or modified or about how we can search for a firm. Accessing this option allows both listing all the firms entered in the database and their updating through the buttons *Add*, *Modify* and *Delete*. These options can be accessed both from the main menu (*Updating firm's* option) and by using some key combinations that are indicated in the right side of the options of this menu. For instance, in order to modify the data of a firm:
  - one can access the *Modify* button;
  - one can choose the *Modify firm data* option from the main menu;
  - one can use the key combination *Ctrl+M*.



Denumire firma	CUI	Reg.Com	Banca	Nr.Cont	Adresa
ADINA 2000 INTERNATIONAL SRL	13142830	J40/5942/2000		0	B-dul Chisinau 2
ALMERA INTERNATIONAL SRL	8574866	J17/1024/1996			
BIT SOFTWARE SRL	5037256	J08/3704/1993			
BRIO S.R.L.	2048501	J27/894/1991		0	B-dul DECEBAL Piatra Neamt
CENTROFARM SA	1559532	J40/3350/1991		0	Calea PLEVNEI 53 BUCURESTI
CONSYS SRL	1553319	J40/21/1992			
ENTELION SOFTWARE SRL	14296144	J40/9619/2001			
INTERTECH SRL	7837689	J40/9218/1995			
LANCE SOFTWARE SRL	156611400	J12/2274/2003			
METEX COM SA	207562	J12/188/1991		0	P-ta 16 FEBRUARIE 3 DEJ
METTEXIN SA	1879766	J13/585/1991		0	Str. ROZELOR MANGALIA
MOKORYTE S.R.L.	13313328	J12/928/2000		0	Str. OASULUI 118 Cluj-Napoca
OPTOEL SRL	12458959	J12/1514/1999			
R & G GLASS INTERNATIONAL SRL	13610213	J40/11684/200		0	Str. MAGURICEA 39 BUCURESTI
SOFTEXPRESS SA	1472664	J38/3/1991		0	B-dul Nicolae Balcescu 30 Rimnicu Vilcea
SRK SRL	14772329	J12/1391/2002			
TRAGET S.R.L.	6291944	J17/2493/1994		0	Str. RAZBOIENI 76 Galati
TRANSILVANIA COM SA	804161	J32/169/1991		0	Str. MIHAI EMINESCU 4 Medias

Figure no. 3 Updating firm data from the database

In this context, when we want to add a firm in the database, if we press the *Add* button, the window from *figure* no. *4* will be appear on the screen.


My Agents - Sistem multiagent pentru regasirea si utilizarea informatiei contabile
Adaugare firma
Adaugare
Abandon

Denumire firma: TARGET SRL

CIF (ex: 3528532, fara RO): 6291944

Nr. Reg.Com: J17/2493/1994

Domeniu principal de activitate: Intermedieri in comertul cu combustibili, minerale, :

Judetul: Galati

Alte detalii:

Figure no. 4 Adding a new firm to the database

Once the rubrics are filled in and the *Add* button is pressed, the firm will be added in the database. If one does not fill in the name of the firm, its identification code or its registered identification number, the firm cannot be added in the database and the user is averted in this sense.

If we want to list, modify or add a financial situation, we should take the following steps:

a. select the firm;

b. press the *Financial Situations* button;

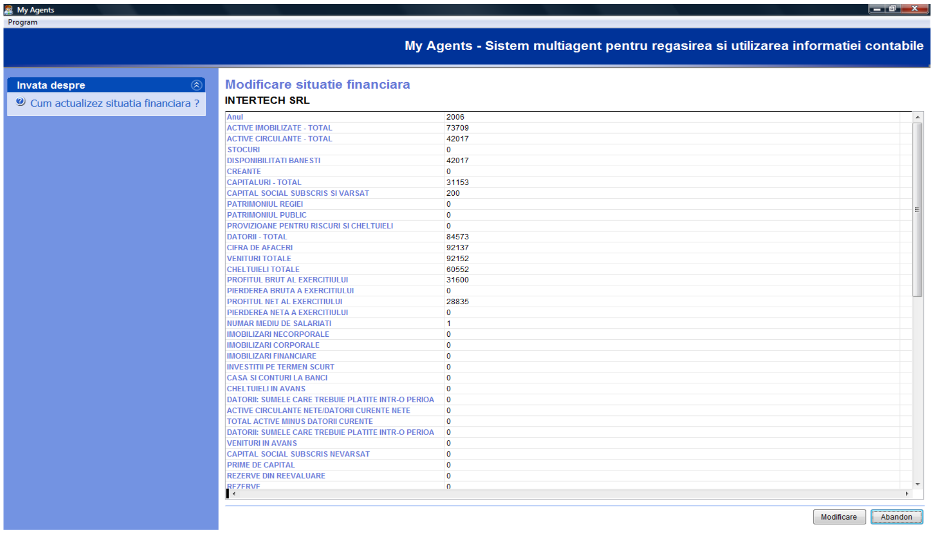
- if we want to add a new financial situation for the selected firm, we should press the Add button. Thus, we shall see on the screen the fill-in form that will allow the user to add a new financial situation related to the desired year;
- if we want to see and modify a financial situation, we should select the appropriate year (on the screen one will see all the years for which there are financial situations in the database) and we should press the Modify button. Thus, we can see or modify the values of the indicators related to a selected firm (figure no. 5).

The third menu (the most important one) includes the four scripts on the basis of which the analyses of the financial-accounting indicators will be conceived (*figure no. 6*). The available options are the following:

- *Scenario 1*: The financial and economic analysis for one firm over one year;
- *Scenario 2*: The financial and economic analysis for one firm over several years;
- *Scenario 3*: The financial and economic analysis for several firms over one year;
- *Scenario 4*: The financial and economic analysis for several firms over several years.

Normally, in order to make analyses or prognoses, we should have at our disposal the values of all the indicators we use (they should be made public). Yet, as we can notice on the site of the Ministry of Finance, each firm lists only the values of certain indicators.

Taking into consideration the public values of some indicators, *MyAgents* system determines the intervals between which the value of a non-public indicator can range, so that the firm should have an optimum activity.



My Agents - Sistem multiagent pentru regasirea si utilizarea informatiei contabile

Modificare situatie financiara

INTERTECH SRL

Anul	2006
ACTIVE IMOBILIZATE - TOTAL	73709
ACTIVE CIRCULANTE - TOTAL	42017
STOCURI	0
DISPONIBILITATI BANESTI	42017
CREANTE	0
CAPITALURI - TOTAL	31153
CAPITAL SOCIAL SUBSCRIS SI VARSAT	200
PATRIMONIUL REGIEI	0
PATRIMONIUL PUBLIC	0
PROVIZIOANE PENTRU RISCURI SI CHELTUIELI	0
DATORII - TOTAL	84573
CIFRA DE AFACERI	92137
VENITURI TOTALE	92152
CHELTUIELI TOTALE	60552
PROFITUL BRUT AL EXERCITIULUI	31600
PIERDEREA BRUTA A EXERCITIULUI	0
PROFITUL NET AL EXERCITIULUI	28835
PIERDEREA NETA A EXERCITIULUI	0
NUMAR MEDIU DE SALARIATI	1
IMOBILIZARI NECORPORALE	0
IMOBILIZARI CORPORALE	0
IMOBILIZARI FINANCIARE	0
INVESTITII PE TERMEN SCURT	0
CASA SI CONTURI LA BANCI	0
CHELTUIELI IN AVANS	0
DATORII: SUMELE CARE TREBUIE PLATITE INTR-O PERIOA	0
ACTIVE CIRCULANTE NETE/DATORII CURENTE NETE	0
TOTAL ACTIVE MINUS DATORII CURENTE	0
DATORII: SUMELE CARE TREBUIE PLATITE INTR-O PERIOA	0
VENITURI IN AVANS	0
CAPITAL SOCIAL SUBSCRIS NEVARSAT	0
PRIME DE CAPITAL	0
REZERVE DIN REEVALUARE	0
REZERVE	0

Figure no. 5 Modifying the values of some indicators related to INTERTECH SRL firm

The four scripts analyse the following financial-accounting indicators:

1. Current Liquidity Indicator (CLI) – is an important indicator that guarantees covering the current debts from current assets, and the recommended accepted value is two. From the two indicators, Current debts is not public. Thus, the system determines the values of this indicator in order to estimate the current liquidity as it follows:

- if Current debts ∈ [x1..y1] then ILC > 2: in this case, the firm can pay off its current debts without confronting with any difficulty: the debts are very small compared to the current assets of the firm. In this situation, we can say that the firm has a very good even excellent current liquidity;
- if Current debts ∈ [x2..y2] then ILC = 2: as we have indicated above, the value 2 is the recommended one (it is the ideal one), in the sense that the economic agent can cover his current short-term debts to the purchasers, employees and other creditors with the current assets and, at the same time, he can benefit from sufficient liquidities that are necessary for its functioning under good conditions;
- if Current debts ∈ [x3..y3] then ILC ∈ [1..2): in this case, the firm is on the level of acceptable liquidity risk and it may confront with difficulties concerning the paying off of its current debts;
- if Current debts ∈ [x4..y4] then ILC < 1: this is an unfavourable situation in which the firm will confront with difficulties concerning paying off its short-term debts; the firm may have pay gaps and it may be in the impossibility of paying off its current debts, being forced to put off some of them.

2. Immediate Liquidity Indicator – this indicator shows the possibility of the firm to cover its current debts with liquidities and the accepted recommended value is two, too. In this situation, too, the system determines the values of the Current Debts indicator in order to estimate the value of the current liquidity indicator.

3. Indebting Degree Indicator (*DDI*) – this indicator is calculated if the firm has borrowed capital, namely, if the firm has contracted medium or/and long-term credits from financial institutions. Otherwise, the indicator is zero.

From the two indicators, the *Personal Capital* is public and it can be found in the balance sheet on the 34th position, while the *Borrowed Capital* is not public. In this context, our system anticipates and analyses the following situations:

a. if the value of the *Borrowed Capital* ∈ [x1..y1] then IGÎ < 0: in this situation the firm's personal capitals are negative, in the sense that the firm has recorded a loss either concerning the previous financial exercises, or concerning the current financial exercise. In both cases, the firm registers a negative indebting degree: namely, it has negative capitals, which means that it can cover neither its personal losses, nor the debts to the banks;

b. if the value of the *borrowed capital* ∈ [x2..y2] then IGÎ ∈ (0..0,5): in this case, the degree of indebting is small. The closer to the value of 0,5% the value of the indebting degree is, the closer to half the value of the personal capitals the value of the borrowed capital is;

c. if the value of the *borrowed capital* ∈ [x3..y3] then IGÎ ∈ [0,5..1]: the degree of indebting is reasonable, from 50% to 100%. 100% means that the value of the medium and/or long-term contracted credits is equal to the value of the personal capital;

d. if the value of the *borrowed capital* ∈ [x4..y4] then IGÎ > 1: the degree of indebting is high, surpassing the value of personal capitals. The bigger than 100% the degree is, the better the situation of the firm is;

4. Rotation speed of immobilized assets – is the indicator that evaluates the efficiency of the management of immobilized assets by examining the value of the turnover generated by a certain amount of immobilized assets. Both indicators are public; the *Turnover* is in the *Profit and loss account* on the 1st position, while the immobilized assets can be found in the *Balance sheet* on the 4th position. The higher the value of this indicator, the better, in the sense that there is a better rotation of fixed assets.

5. Rotation speed of total assets – this indicator has the same significance as the previous one, with a single difference, namely, it targets the efficient use of all the assets the firm has had at its disposal in a financial exercise. In the case of this indicator, a higher value indicates a a better rotation of the firm's assets, too.

In this context, by means of the four scripts, the system analyses these indicators for one firm or for several firms, over one year or over several years.

For example, *Scenario 4* offers the possibility of more complex analyses, in the sense that one can select several firms for which the analysis of the indicators is made over two, three or four years. Thus, after specifying the domain of activity, the user has to tick the years for which he wants to have the analysis of the indicators. Then, maximum five firms will be selected of all the extracted firms. The graphic representations related to the indicators *Rotation speed of immobilized assets* and *Rotation speed of total assets* are presented in *figures 6* and *7.*

By analysing the graphic representations from figures 6 and 7, an investor would observe that the best situation concerning the rotation speed of the assets belongs to the firm *BIT Software SRL*, which is nevertheless in decline in the last year of the analysis.

Thus, we consider that all the information *MyAgents* system offers can be useful and will contribute to making a decision concerning the investment of financial resources in a firm whose analysed indicators have good values. We believe that a system that is not based on the technology of intelligent systems will not be able to offer all this information in due time, in such a way that the interested persons benefit from them in as useful a manner as possible.

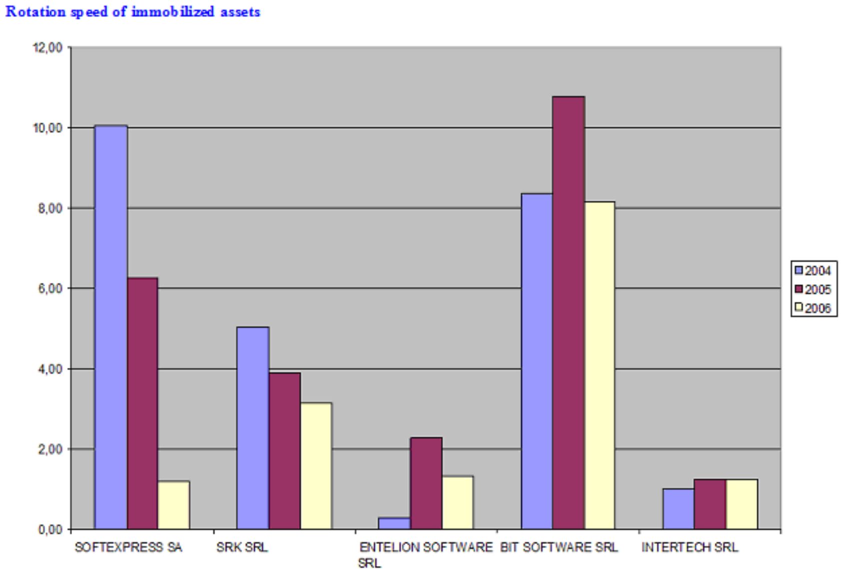


Figure no. 6 Rotation speed of immobilized assets in the years 2004, 2005 and 2006 for the specified firms

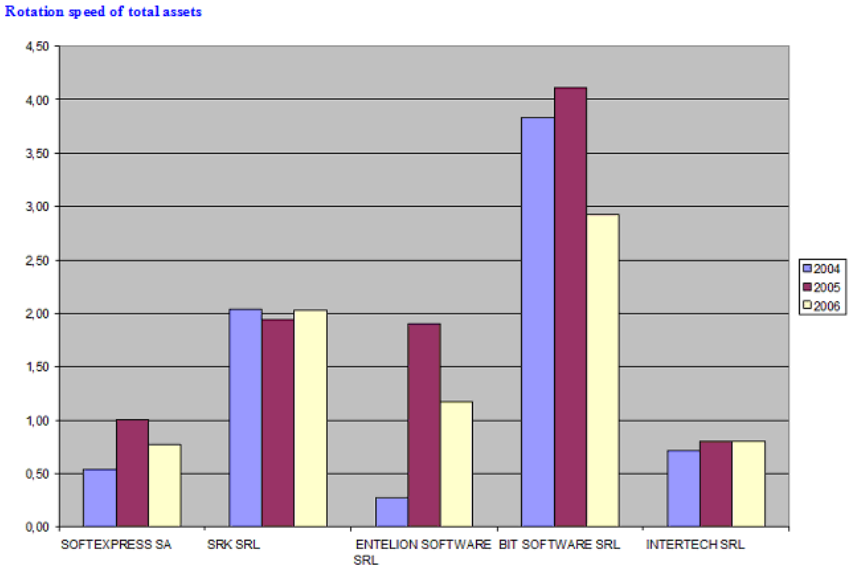


Figure no. 7 Rotation speed of total assets in the years 2004, 2005 and 2006 for the selected firms

6. CONCLUSIONS AND FUTURE RESEARCH

By conceiving a multi-agent system for the research and operating of financial-accounting data, we have emphasized the advantages and the benefits of using intelligent technologies and we have made a breakthrough in the developing of intelligent systems in the accounting field.

Our conclusions, that round off a prolonged research activity, single out the necessity of the introduction and rapid adoption of intelligent systems in the accounting field, a field in which technology can play an extremely important role. The adoption and using of modern technologies generate advantages and important benefits, enable decisive actors to make the most adequate decisions that shall guarantee the success of their businesses and better the activities of each organization.

In addition, through this paper, we aim at appealing to the researchers, but also at training the skills of accountants and managers in the domain of intelligent technologies in order for them to be able to practically implement the appropriate solutions for the financial-accounting analyses.

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