BUSINESS INTELLIGENCE SOLUTION FOR ROMANIAN SMES ASSOCIATED IN A NETWORK BUSINESS ENVIRONMENT

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The academic community, the researchers, the specialists, they all sustain Business Intelligence solutions as the best method in processing data as results from the literature review. In this article we made a literature review of possible Business Intelligence (BI) solutions that might be adopted by Small Medium Size Enterprises (SMEs). As a case study we created a data structure with Romanian SMEs economic-financial data and made a financial analysis for a SMEs using Qlik View BI on that structure. The analysis is easier if SMEs gather in a network business environment using a platform as a service.

Keywords: Business Intelligence, SMEs, open source, data structure, dashboard, KPI.

1. Introduction

Today the SMEs feel the pressure of competition, of economic crisis and big volume of data processing. The variety of data format and difficulty of processing determine the experts to design appropriate software to help entrepreneurs to make well informed decisions. The most popular and efficient solutions for processing big volume of data nowadays are Business Intelligence (BI) solutions. In this paper we reviewed the literature regarding BI solution and we chosen QlikView BI. We designed a data structure with Romanian SMEs economic-financial data and processed these data with QlikView.

2. Research methodology

For this application we decided to study the literature with the focus on BI. Our study has 5 steps:

1. Defining the research questions to answer: What BI means and what problems solves?, What BI solutions the market offer?, Which BI solution is better for SMEs?;

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2. Choosing databases to search articles, chapters' books and scratch. In this respect we have chosen Web of Science, EBSCOhost, IS journals and IS conference proceedings;

3. Screening papers and extracting information that might be transformed in knowledge. There have been chosen only materials published after 2012. For the selection we asked several keywords, such as: "Business Intelligence & Analytics", "Business Intelligence", "BI trend", "BI for SMEs", etc.;

4. Designing a data structure in Oracle Sql Developer, version 4.0.1, 2014. The data structure contain information regarding Romanian SMEs: name, contact information, activity' domain (CAEN: Classification of Activities in the National Economy), economic-financial data (assets, liabilities, equity, debt, stocks, net income, total expenses, turnover, profit, number of employees, etc. on a period of 2006-2013; The data were taken from the Romanian Finance Ministry - Tax Information and balances: http://www.mfinante.ro/, where there were no data available for 2014 and 2015).

5. Choosing on BI solution and apply it in relation with the SMEs data structure in order to obtain dashboards, dynamic report.

3. Literature review

3.1. What BI means and what problems solve?

"Business Intelligence (BI) is a term that defines a set of informatics applications with economical background, used into companies to analyze data in order to transform them into information that will be the base of decisions taken by managers." [1]

"Business intelligence & analytics (BI&A) has evolved to become a foundational cornerstone of enterprise decision support. BI&A adoption, firms are increasingly adopting BI&A technologies like dashboards, adhoc query and interactive visualization etc. to support decision-making." [2]

In the latest years, when the big volume of data processing is more necessary, the BI&A has arisen the interest among academics and researchers, too. They came with different solution for improving BI&A features.

Modern BI have to be available on mobile, allow self-service and collaborative environment. The BI available on mobile has to provide functionality for all of the multitouch gestures, such as mobile interface do, has to provide ability to utilize the information capture for QR codes, accelerometer data, bar code readers, and speech recognition. In the self-service BI rudimentary actions that would be taken based on a shallow view of data have already been thought of and taken in these environments. Those actions have been built into the environment, along with the standard business rules needed by the analyst. The user has to do more technical interactive analysis. The modern BI has to include

methods of collaboration such as discussion forum or workflow component, allowing cooperation between company members, to fundament and interpret data and reach correct conclusions, [3]

The Business Intelligence Environment, [4]: "The BI environment incorporates a spectrum of capabilities ranging from the operational aspects including data extraction, data integration, parsing and standardization, and data cleansing and validation, all the way to the analytical parts including data warehouse platforms, analytics tools, OLAP cubes, data mining, presentation schemes, and visualization methods for creating scorecards, dashboards, and other types of visualizations, graphical presentations, and mashups."

Business Intelligence solutions are provided with tools and techniques that help entrepreneurs to analyze, understand and foresee complex business situations. BI tools allow entrepreneurs to make decision in real time having in front the entire panoply of situations that the business was or may confront. This panorama is of crucial importance in periods of financial and economic crisis and in very competitive environment such as the one faced by the actual SMEs. BI tools help companies to reach their goals, such as improved productivity, lower costs, reliable performance, reductions in paperwork, saving time etc. [5; 6]. BI solution allows entrepreneurs extract useful information and transform it in knowledge, from the constantly growing volumes of digital data, increasing revenues, by decreasing costs, and increasing productivity. BI tools bring the opportunity to calculate Key Performance Indicators, to make complex analysis, such as What-If. BI systems are very important in respecting the agreements with customers, efficient communication with them and in real time. [7].

From the technical point of view a Business Intelligence solution BI includes: [8] a) Data warehousing - architecture, modeling, storage, managing, data processing; b) ETL process extracting, transforming, loading and data integration; c) Implementation of reports, data visualization, dashboards, d) Online Analytical Processing OLAP and multidimensional data analysis; e) Data mining, statistical analysis, forecast

One of BI shortcomings, that the literature review reveals [9] and we consider important, is a strong focus on structured, enterprise-internal data, but lack the capability of integrating external and/or unstructured information in an easy, (near) real-time and effective way. Thus, some useful information can be lost and affect the business panorama that can be followed by wrong business decisions. This shortcoming can be exceeded if the SMEs form a Network Business Environment, based on Cloud technology, where the information is free and available for all the environment members.

An interesting feature of modern BI in the era of big volume of data to be processed is transforming ETL (Extract, Transform, and Load) process in ELTA (Extract, Load, Transform and Analyze) process. ELTA offer more flexibility in

reflecting environmental changes and short the time BI solutions are implemented. The transformation over the date is done after the loading process, according to the business needs. Usually the data is extracted from heterogeneous sources in heterogeneous formats, then stored in a new data structure and then transformed accordingly to the needs of business in which is made the decision. The new process called Analyze imply using transformed data in statistical, economical etc model in order to capture new, interesting, unsuspected features of the business. These data can be used in forecasts, what-if analyses etc.

From the designer and maintainer perspective the BI solutions have to offer an infrastructure for information and management support, have to be safety reliable, and easy to maintain. From the customer perspective the BI solutions have to offer information in real-time, has to be practically, friendly and economic. BI solutions have to help managers in the process of decision-making, customer identification, reduce costs, offer a innovative business model and offer external communication (sharing, leading, cost-effective and offer quality information) [10]

From the Marketing perspective BIS has to process data regarding: [11] a) People (demographics, social networks, customer review, click stream, survey data); b) Product (characteristics, category, customer data, survey data); c) Promotion (data regarding promotion campaigns, survey data); d) Price (transactions, survey data); e) Place (location based social networks, survey data)

As methods to analyze these data we can mention: clustering, classification, association, regression, collaborative filtering.

In [12], the way SMEs use BI from ERP systems is analyzed. The study shows that SMEs do not take full advantage of the business intelligence capabilities. That result may indicate the lack of economies of knowledge, and the under-utilization of the capabilities of the ERP system, resulting to poor ROI, and less efficient management and marketing decisions, that are critical in times of crisis. However, as expected the perceptions of the advantages emanating from the implementation of ERP systems are highly and positively correlated with the perceptions of business intelligence capabilities that the system delivers.

Proprieties of BI reports are:

- Ease to use: BI reports are intuitive, allows discovering new information through graphical representations and they are dynamic: it can be changed with multiple filters, drill-down or drill-up operations.
- Flexible: BI reports can be designed under different types of operating systems and different versions, and under multiple types of databases.
- Easy to customize: BI reports can be designed as the user need, he can choose the parameters the graphic representations, the objects to drag in report (list box, multi box, statistics box, search box, input box, container, buttons, lines, etc) in order to meet each user requirements

- Data security: The database can be encrypted with different algorithms such as RSA and AES, and the admin can create different roles for de end-users and to share only what is necessary. As well each BI report page can be encrypted

- Trend: in the era of big volume of data to be processed the BI solutions tend to integrate Cloud Computing technologies

The BI solutions/products have modular functionalities that include, [8]: a) dashboards - easily customizable, allowing better and faster real-time decisions; b) KPI indicators, alert generators and exceptions reports, are also provided; c) localization and business data visualization in geographical or geo-location format; d) what-if analysis - which allow the company management to assess the potential impact of business decisions in simulated stages, before confronting the reality; e) interactive reports - help the final beneficiary to transform data into knowledge, allowing visualization and analysis through various types of reports and graphics designed to be used as decision support; f) sharing, distributing information to users, viewable in normal, easily interpretable format.

3.2. What BI solutions the market offer?, Which BI solution is better for SMEs?

Generally speaking all SMEs' entrepreneurs, regardless of the industry they belong to, accept the necessity of adopting BI solutions for real time decision making. Nevertheless they still need to decide which BI solution to choose. There are two big categories: Open Source (OS) BI or commercial BI that are detailed below. The entrepreneur will have to take into account the technical infrastructure, human and financial resources need for implementing BI solution. If the entrepreneur choose an OS solution the license cost are reduced, but there he still has to manage the cost and time needed to teach the human resources how to efficient exploit the adopted solutions. Otherwise, the entrepreneur may opt for a method of sharing hardware and software, such as Cloud BI, in order to pay only for the services used and for increasing performance in information processing [13].

Open source BI Solutions/products

Using open source solutions is a modern trend for European companies. This trend is very well motivated while OS offer free license and technical support on the solutions' forum. Most of the big and small companies use Apache web server, Linux operating system for their servers and MySQL database management. There are OS solutions with licensing costs, but the cost for an OS solution is smaller than the cost for a commercial license. OS solutions are very stable, flexible, and reliable. It remains that the users get used with its. OS seems to be dedicated for SMEs.

Beside operating systems and database management software OS offer a wide range of solutions such as for financial accounting (GnuCash:

http://www.gnucash.org/), image processing (GIMP: www.gimp.org/), Business Intelligence (Freereporting.com: http://www.freereporting.com/, Eclipse BIRT Report Designer: http://download.eclipse.org/birt/downloads/, Palo (OLAP database): http://www.jedox.com/de/home/uebersicht.html, SocrateOpen: http://www.bitsoftware.eu/ro/products-content/socrateopen.html, Actuate BIRT Business Intelligence and Reporting Tools www.actuate.com/products/, SpagoBI: www.spagobi.org/, Jaspersoft: www.jaspersoft.com/), etc. The BI solutions are designed for reporting and decision making.

Commercial BI Solutions/products

As it was expected, the giants of software development, such as Microsoft, Oracle, IBM, SAP and SAS Institute, created also BI solutions. But there are also specialized software companies that developed Information Builders, MicroStrategy, Panorama Software, QlikTech, Actuate, etc.

These solutions have also free demo editions that for SMEs with a smaller activity may be taken into account. In this regard, we have applied the QlickView BI interface on Oracle Sql Developer database with financial dates regarding Romanian SMEs. (fig. 2, 3, 4, 5).

Modern BI solutions are turning to intelligent process automation, monitoring events (BI ubiquitous and context sensitive), content analysis, process monitoring, predictive analysis, and alerting users on the occurrence of certain events. They have to enable [14] Business User Data Mashup and Modeling, Internal Platform Integration, BI Platform Administration, Metadata Management, Cloud Deployment, Development and Integration, Free-Form Interactive Exploration, Analytic Dashboards and Content, IT-Developed Reporting and Dashboards, Traditional Styles of Analysis, and to enables organizations to develop and deliver content to mobile devices, Collaboration and Social Integration and Embedded BI.

Taking into account all these criteria Gartner Company published a study regarding BI solutions, called 2015 Gartner Magic Quadrant for BI &Analytics Platforms. The result of the study reveals that the leaders are Tableau, Qlik, Microsoft. In our case study we have chosen Qlik. [15]

4. Case study: Financial analysis for a Romanian SMEs using Qlik BI

Our data source for BI solution includes data on SMEs in Romania and their activities. We have choose the data source dimension and the entity table-of-facts in accordance with the requirements of cooperation and competition between SMEs in Romania, presenting relevant information on which we can measure firms economic and financial performance for decision making in order to establish medium and short term business strategies. Decisions will reflect the

coherence, materialized in profitability, solvency, and profitability of companies. Historical data type allows what-if analysis, scenario analysis and forecasting type, which also affect the company's business strategy. Data source highlights trends, directions and exemptions for long periods of time. The source data structure is represented schematically in Figure 1.

Fig. 2 is a dynamic report for localization and business data visualization in geographical format that allows the user to search for a Romanian SMEs and to get the contact details, the CAEN code and the economic-financial data (assets, liabilities, equity, debt, stocks, net income, total expenses, turnover, profit, number of employees) for 2006-2013 periods.

Fig. 3 is a dynamic report with SMEs' KPI indicators such as economic, social and commercial profitability.

Fig. 4 is a dashboard regarding SMEs' solvability, such as general profitability, capital profitability, financial stability rate, financial autonomy rate, overall borrowing rate, debt recovery time, rotation of current assets time, inventory turnover time, and financial leverage.

Fig. 5 is a dynamic report that present a What-if analyze for Romanian SMEs. We may see how total income influence the net profit, or how brut profit can be influenced by economic profitability and if the SMEs was profitable for each year in 2006-2013 period. A SME is profitable if the economic profitability is bigger than the interest rate and, in the same time, the financial profitability is bigger than the economic profitability. (RE>RD and RF>RE). It is favorable to work with credits if the economic profitability is bigger than the interest rate, because has as consequence using more efficient the capital.

SME that has access to this Network Business Environment has access to all these analyzes for every SME in database. Thus they can choose a valid business partner. The database can be improved with other information regarding the services and products of the NBE members. Thus the SMEs advertise free.

In our case study, the company AGRA OARDA SRL (Alba County) is working in the field of preparation and spinning of worsted-type fibres. For the year 2012 it had a net profit of 77851, with 5 employees, with a value of current assets of 486040, a value of total liabilities of 290725, and a value of total expenditure 690303 etc. Contact data of the owner of the company is shown in Fig. 2.

For the same company, in the year 2012, we calculated the economic profitability (RE) of 17.86, financial profitability (RF) of 38.44 and commercial profitability (RC) of 13.83. In this case RE > RD and RF>RE. This is a profitable company and it is safe to do business with it.

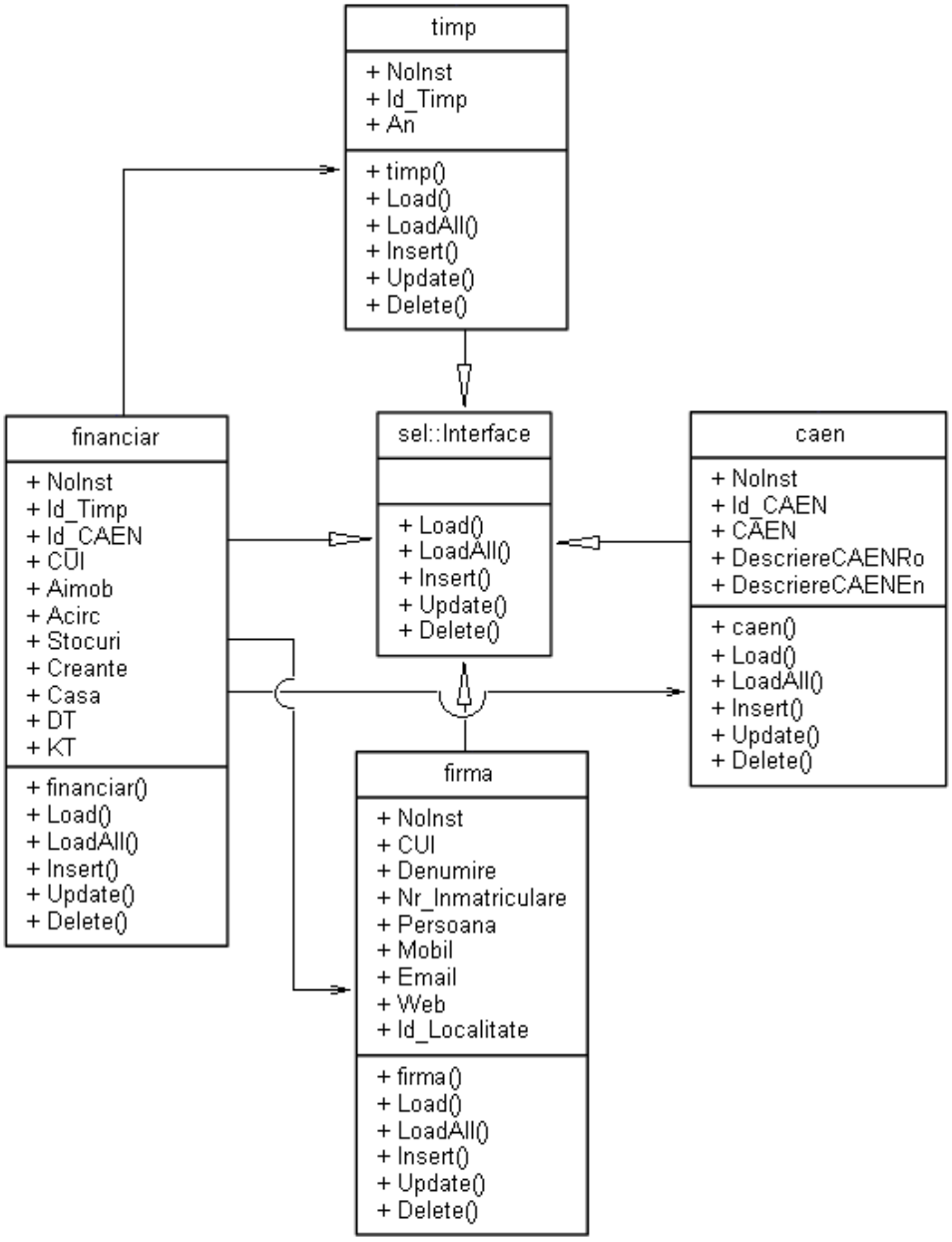

Fig. 1. The object oriented model designed to evaluate the financial and economic activities of SMEs

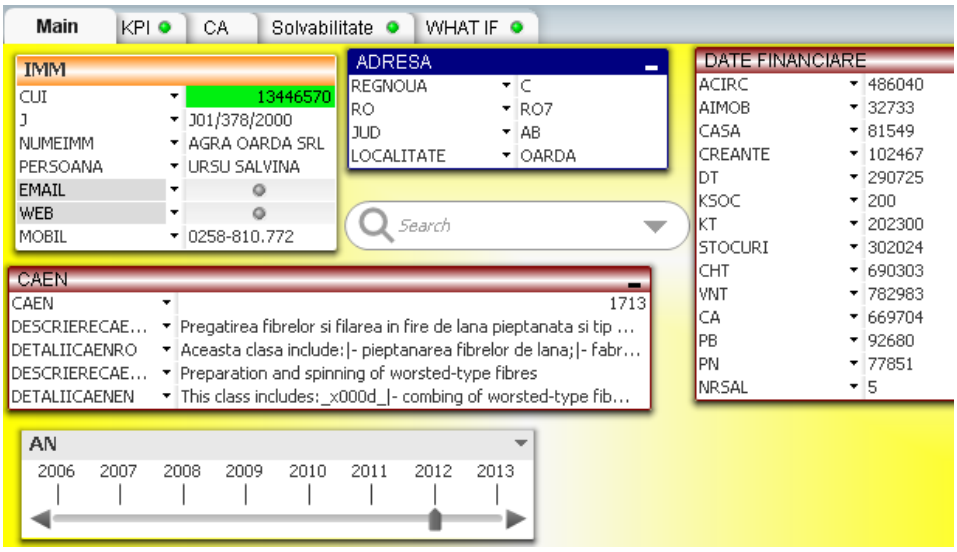

Fig.2. Localization and SMEs' business data visualization (QlikView), Source: own research

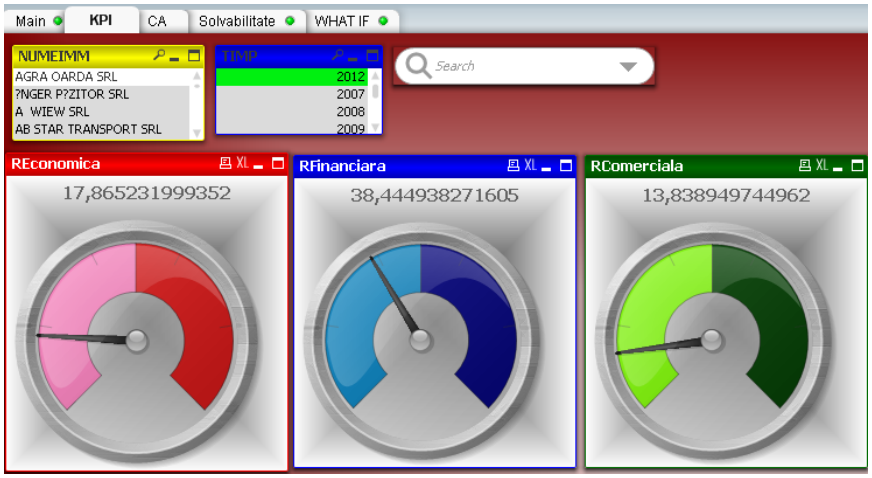

Fig.3. SMEs' Key Performance Indicators (QlikView), Source: own research

Economic profitability is calculated as follows: RE = Gross Profit / Total assets * 100

Financial profitability is calculated as follows: RF = Profit / Equity * 100

Commercial profitability is calculated as follows: RC = Result Exploitation / Turnover * 100,

The relationship between profitability is: RE > RD and RF > RE, where RD is the interest rate. If RE > RD recourse to borrowed capital will increase financial profitability, as financial leverage it will be positive and will return to shareholders (RF > RE). In this case, the organization will have to use as much

interest loans to take advantage of financial leverage, but to limit the risk of insolvency.

In our case, the financial risk of the company is small and any company can enter into partnership with AGRA OGRA SRL. The company can obtain a credit.

For our company, the profitability of total assets - ROA is not very high and amounted to 15. The company is economically viable because conditions RE > interest rate and RF > RE are met simultaneously. Company has to analyze his activity in order to increase net profit (PN = 77 851), which is too small relative to capital and gross profit (PB=92680), which is too small compared to the value of total assets (AT = 518 773) and the result is a small economic profitability.

The company must also give importance to the general creditworthiness that is low, of 1.78, reducing total debt. Financial autonomy rate is 13.66: firm may increase its own capital, which is small in relation to total liabilities. Financial lever value of 6.66, above the threshold of 5 indicates that a company is easy undercapitalized. Financial stability is high, its rate having a value of 64.57. The overall indebtednes rate of 58.94 is high and total debt reduction is recommended. Return on Equity - ROE is 99.74 exceeds the current interest rate, which means that the company can make investments.

The assets ratio is 6.3, while that of assets is 93.6. It can be considered that the company does focus to invest the capital, and it is advisable to review its investment policy. Depending on the nature of the company further conclusions can arouse and make decisions accordingly. The rotational speed of current assets is 264 days, is very high. The stock rate is 164 has a high value. The recovery time rate is 55 days and the debts recovery rate is158 days. These are favorable if low levels, but the firm is not the case. The company pays its debt in a longer time than collect debts. Rate debt is 0.5 which favors creditors, because the rate is lower with greater protection from creditors in case of liquidation losses.

What- If analysis simulates the influence of total net income variation on net profit. Fig. 4 shows a variation of total net income upside of 20%, would result in an increase in net profit, in the event of sustained total expenditure (red curve, the lower curve in chart). In the graph are represented the values of net profit for the period 2007-2013 of AGRA OARDA SRL company. Observe how in 2013 net profit (3490) fell to approximately one third of the profit in 2012 (9631), the difference increased about 22 times compared to 2007 (77,851). The graph is similar to that of a second degree polynomial advanced function, whose regression equation is shown in Fig 5. The coefficient of determination R2 has a high value (0.97), meaning that the regression equation adjusted very well data.

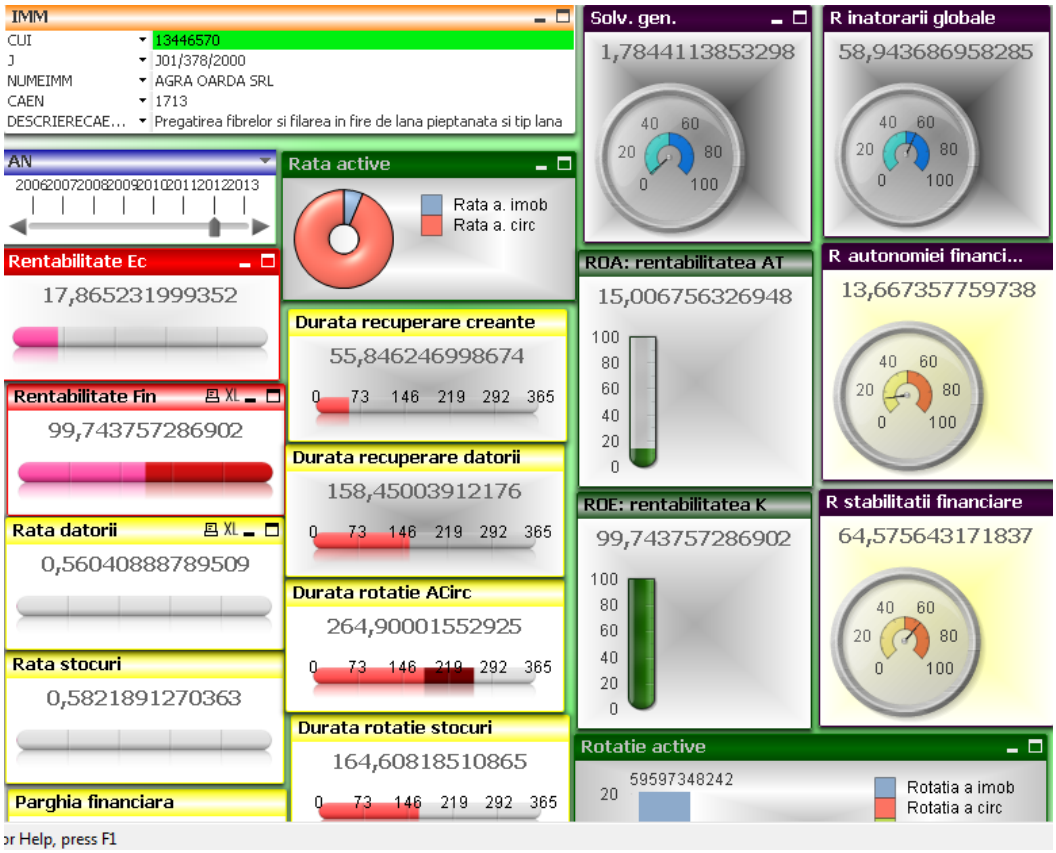

Fig.4. Dashboard regarding SMEs' Solvability (QlikView), Source: own research

$$Y = 1947.9x^2 - 24994x + 83114 \quad (1),$$

where Y is net profit, and x is total net income. The regression equation for the influence of total net income variation on net profit for period 2007-2013 is similar to that of a third degree polynomial function.

$$Y = 486.97x^3 - 2045..2x^2 - 20253x + 96815 \quad (2),$$

where Y is variation of net profit, and x variation of is total net income.

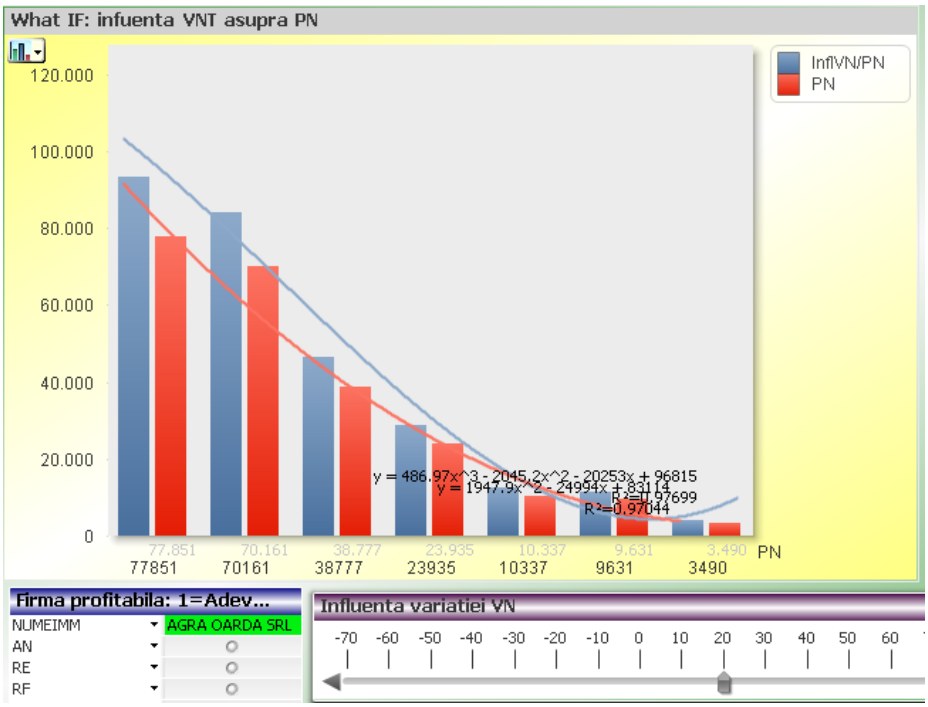

Fig.5. What If Analysis, Source: own research.

6. Conclusions

In these article we demonstrated how important is to use BI for SMEs and that it is possible for SMEs to associate in a network business environment (NBE) in order to get access on information in real time. In this regard, we designed the data structure with data of Romanian SMEs and using a BI interface we process data easily and rapid for a Romanian SME. The same analysis can be done for every SMEs in the network, with only some clicks. Our solution offers semantic autodiscovery and intelligent profiling for users. The charts analyze the data by interacting directly, the user having a visual representation of it. Ad hoc query enables users to ask their own questions of the data, without relying on IT to create a report.

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R E F E R E N C E S

[1] *Berta Dora-Anca*, "Study Regarding the Perception of the Concept of Business Intelligence Among Application", Procedia - Social and Behavioral Sciences, Elsevier, **vol. 109**, 2014, pp. 402 – 406

[2] *Nadine Côrte-Real et al*., "The diffusion stages of business intelligence & analytics (BI&A): A systematic mapping study" Procedia Technology, Elsevier, **vol. 16**, 2014, pp. 172 – 179

[3] *William McKnight*, Chapter Fifteen - Modern Business Intelligence—Collaboration, Mobile, and Self-Service: Organizing the Discussion and Tethering the User to Information, Information Management, 2014, pp. 158-167

[4] *David Loshin*, Chapter 5 - The Business Intelligence Environment, Business Intelligence (Second Edition), 2013, pp. 61-76

[5] *Dekoulou P & Trivellas* PG, "Learning Organization in Greek Advertising and Media Industry: A way to face crisis and gain sustainable competitive advantage", Procedia - Social and Behavioral Sciences, **vol. 147**, 2014, pp. 338-347.

[6] *Trivellas P. & Santouridis I*., "Antecedents of Task Innovation: The role of Management Information Systems", Procedia Social and Behavioral Sciences, **vol. 73**, 2013, pp. 683-691

[7] *Marinagi C., Trivellas P., Sakas D*., "The impact of Information Technology on the development of Supply Chain Competitive Advantage", Procedia - Social and Behavioral Sciences, **vol. 147**, 2014, pp. 586-591.

[8] *Tutunea Mihaela Filofteia and Rozalia Veronica Rus*, "Business Intelligence solutions for SMEs", Procedia Economics and Finance, Elsevier, **vol. 3**, 2012, pp. 865 – 870

[9] *Pablo Michel Marín-Ortega et al*., "ELTA: New Approach in Designing Business Intelligence Solutions in Era of Big Data"", Procedia Technology, Elsevier, **vol. 16**, 2014, pp. 667 – 674

[10] *Su-Li Yan et al*., "Research on the Comprehensive Evaluation of Business Intelligence System Based on BP Neural Network", Systems Engineering Procedia, Elsevier, **vol. 4**, 2012, pp. 275 – 281

[11] *S. Fan et al*., "Demystifying Big Data Analytics for Business Intelligence Through the Lens of Marketing", Big DataResearch, Elsevier, **vol.** 2, 2015, pp. 28–32

[12] *Antoniadis et al*., "Business Intelligence during times of crisis: Adoption and usage of ERP systems by SMEs", Procedia - Social and Behavioral Sciences, Elsevier, **vol. 175**, 2015, pp. 299 – 307

[13] *Bamba, J*., 2012:" Year of Cloud BI, published": January 24, 2012, available online at http://tdwi.org/articles/2012/01/24/2012-year-of-cloud-bi.aspx, accessed on 22/04/2015.

[14] *** Rita L. Sallam, Bill Hostmann, Kurt Schlegel, Joao Tapadinhas, Josh Parenteau, Thomas W. Oestreich, Magic Quadrant for Business Intelligence and Analytics Platforms, 23 February 2015, http://www.gartner.com/technology/reprints.do?id=1-2ADAAYM&ct=150223&st=sb:

[15] ***Gartner study regarding BI & Analytics Platforms, http://www.informationweek.com/big-data/big-data-analytics/gartner-bi-magic-quadrant-2015-spots-market-turmoil/d/d-id/1319214