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# IMPROVING FINANCIAL REPORT GATHERING AND ANALYSIS PROCESS THROUGH IMPLEMENTATION OF CENTRALIZED DATA EXCHANGE SYSTEM

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**Abstract:**
This study is focused on the process of gathering and analysis of financial reports, which includes activities such as data preparation, exchange, processing and analysis. Main goal of this research is to identify key factors on how to improve this process and make further cost savings in the state of global recession. This process is aimed at information technology project managers and specialists as it describes development of centralized data exchange system for Republic of Srpska Securities Commission, identifies the advantages of structural, digital data exchange and provides further development paths and list of possible risks for implementation of such information systems. Findings of this research support the theory that, by reducing the number of activities in the process of data exchange, processing and analysis, organizations can make significant cost cuts. Such data exchange systems enable central data-entry in structured, relational database, which in the end eliminates several persistent issues. Firstly, it eliminates the need for initial entry of unstructured data and consolidates various channels of data exchange into single channel/system on the client side.
Secondly, it eliminates data conversion process automates verification of information correctness and improves process of data warehousing, analysis, and distribution of data on the service provider side. Results show that by eliminating certain time-consuming activities, whole process is improved and organizational performance is significantly optimized.
**Keywords**: financial reports, data exchange, data processing, data analysis, capital markets, Web-based applications, XML, Republic of Srpska Securities Commission.

## 1 INTRODUCTION

Digital, or information age, is over two decades behind us, but still individuals, small business and global corporations are searching for better ways to utilize this technology. Digital data exchange was the main focus of information technology specialists and today we are able to exchange almost any information we create, whether it is in digital or paper-based form. With world-wide network, the Internet, exchange is simplified, always available, fast and reliable. However, one important question came to rise in the last decade: *how do we process digitally exchanged data*? Various data formats, standards, unstructured forms of data have created a persistent issue of inability to fully use the digital data. This has set information technology specialists with a tremendous task of creating data processing and conversion systems, and put a great overhead on already over-allocated employees. With global financial crisis still over us, these activities are becoming more and more expensive and businesses are trying to identify how to improve data exchange and usage processes.

## 2 THEORETICAL ASPECTS OF FINANCIAL REPORTS GATHERING AND ANALYSIS PROCESS

### 2.1 Financial reports and information dispersion on capital markets

Financial reports, formal records of financial activities and position (Bandler, 1994, p. 4), are one of the basic means of releasing the information about businesses[1]. They do not exist for the sole purpose of being written and archived, but to inform all present and prospective stakeholders, so that important investment decisions can be made. Typically, financial reports include four basic financial forms (Deloitte Touche Tohmatsu, 2010): balance sheet, income statement, statement of retained earnings and statements of cash flow.

However, financial reports alone do not provide means of releasing all relevant financial information to investors. Modern capital markets have a great number of institutions, other than listed companies, such as: stock exchanges, brokerage firms, investment funds, investment fund management companies, custody banks, deposit banks, central registry/bank of issuers, etc.

[1] Financial reports focus primarily on financial information of a company

All of these institutions have the obligation to inform the central capital market regulatory authority, Securities (and Exchange) Commission (SEC in further text), and all investors regarding significant financial information (Campbell, 2007). SEC, by rule, requires extensive number of financial information to be disclosed than is being published freely to the investors, primarily in order to predict and analyze capital market trends, detect manipulative, money-laundering and other unlawful trading activities, process mergers & acquisitions, etc.

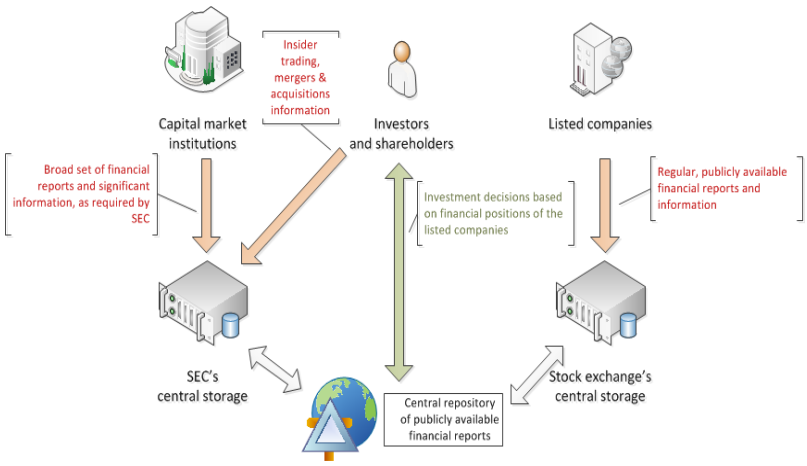


Diagram 1 - Basic structure of financial reports disclosing and usage on capital markets (source: CESR's consultation paper, 2006)

According to recommendations[2], in European Union member states, SEC and stock exchanges provide the central point for publishing all publicly available financial reports (whether their own Web sites, or independent capital market Web portal), while SEC generally holds its own central database for non-public financial information (as illustrated in diagram below).

### 2.2 Traditional processes of financial information gathering and analysis

Before the information age, all data was exchanged in paper form, which presented a huge obstacle in further processing and analysis. With information technology, business and government institutions were able to exchange data in digital form, which lowered the costs of data exchange process. *Traditional process* of financial information exchange refers to exchange of unstructured or semi-structured data. *Unstructured data* is the term that describes data that primarily exists as data without structure, or in popular term, is a digitalized variant of paper document (Buckland, 1997). Scanned documents primarily contain unstructured data, but also the digitally-born documents, created via computer applications. More formal definition of term unstructured data is: the data that doesn't have any background structure, as it does not exist in database, but rather in free-form document (Grimes, 2005).

Exchange of unstructured data itself has significant advantages over paper-based documents, such as: digitally-born data need no preprocessing (scanning/converting documents in digital form), exchange can be done via almost any presently available channels (special leased lines, Web, email, Internet), data storage is simplified and data is searchable.

Information systems generally are able to generate data in unstructured form. For example, an accounting system will easily allow users to export the balance sheets into most common formats (PDF, spreadsheet, rich text file, HTML document etc.). In the perspective of data preparation, traditional process has the advantage over paper-based report preparation, which included several accountants working several weeks to calculate data for a balance sheet.

Processing and analysis of the data presents, however, a huge obstacle that information technology specialists and scientific communities have been trying to address for big periods of time. Comparison of individual financial reports, analysis of trends in target economic sectors, graphical representation of data, data mining or business intelligence are not possible to apply to unstructured data without significant resources used per data analysis activity. Processing of unstructured data involves detecting data elements, structure and relations, in order to transform it into fully structured data, or to create a temporary structured data, such as a spreadsheet document. This data can be further analyzed, but only as much as used computer applications allow it. For example, using a spreadsheet document, data can be organized, analyzed, graphically represented, but only to extent of Microsoft Excel's functions and imposed software limitations.

Modern capital markets, even in the case of small countries, have at least several hundred listed companies, millions of investors and a great number of diverse financial reports prepared, exchanged, processed and analyzed. Since the processing and analysis of this information presents a huge task and investment, there was a clear need for optimization of data processing and analysis activities.

[2]*Committee of European Securities Regulators* (CESR) published in January 2006 document entitled „CESR's Consultation Paper on Possible Implemeting Measures Conserning the Transparency Directive", which focuses on development of central storage meachanisam of financial information (The Committee of European Securities Regulators, 2005, p. 7)

### 2.3 Modern processes of financial information gathering and analysis

In the last decade, much effort was focused on developing a model of data exchange that would enable significant cost savings. As we identified in previous paragraphs, main issue with traditional process of financial information gathering and analysis is actually fact that, although companies have employed information technologies, the process itself needed was not entirely optimized. Digital data is not entirely usable if it is in unstructured form (Aberdeen Group, 2007, pp. 5-9), so the digital exchange is only a part of the solution. In order to benefit from data exchange in digital form, data needs to be fully structured.

*Fully structured data* is term that describes data that exists in structured, relational database system. If a data is structured, than it is fairly easy to do any kind of calculations, summarizations and advanced data filtering and analysis (Chen, Wang, Liu, & Lin, 2009). Modern database systems enable transformation, selection, processing and advanced calculations on the structured data. Comparison of traditional and modern data gathering and analysis processes is given in the following table:

Table 1 - Activities in traditional and modern data gathering and analysis processes (source: author)

| Actor | Activity | Traditional process | Modern process |
|---|---|---|---|
| Sender | Extracting the data from data source (sender's information system) | ✓ | ✓ |
| | Forming the unstructured document | ✓ | |
| | Distributing data through an exchange channel (data entry into foreign information system) | ✓ | ✓ |
| Receiver | Processing of received data - conversion of unstructured data into structured data | ✓ | |
| | Verification of processed data | ✓ | |
| | Manual preparation for data analysis process | ✓ | |
| | Automated preparation for data analysis process | | ✓ |
| | Automated loading of newly received data into analysis projects | | ✓ |
| | Full data mining and business intelligence | | ✓ |
| | Automated distribution of received data (through a Web site) | | ✓ |

Exchange of structured data allows gathering and analysis process to be streamlined, in sense that several time-consuming activities are completely removed. As illustrated in the table above, modern process removes the need for generation and transmission of unstructured document. Structured data is, therefore, directly exchanged between two information systems. *Conversion of unstructured data* into structured database and *verification* of conversion process[3] are two other significant activities that are being removed, since exchange of structured data does not deal anymore with unstructured documents/data.

Advantages of modern process are in higher-level activities, such as automated loading (refresh) of newly received data, data mining and business intelligence capabilities. Also, they support of further data distribution, though Web-technologies (Web sites, RSS feeds and XML exchange).

## 3 RESEARCH METHODOLOGY

In order to adequately research aspects of modern data gathering and analysis process and confirm theoretical assumptions, this paper presents experimental implementation of modern process model. Experimental research in this paper was conducted at Republic of Srpska Securities Commission[4] (RSSEC in further text), which is the capital market regulatory body in Republic of Srpska, Bosnia and Herzegovina[5]. Author of this paper is employed by RSSEC as information technology project manager.

RSSEC has been using a mixture of paper-based and traditional process for data gathering and analysis of financial reports, since its formation as capital market regulatory body in 2000, up until beginning of 2009, when it started using the modern process. Initial paper-based data exchange was replaced by exchange of spreadsheet files early in 2005. This transfer to traditional process, and several years of usage, allows comparison of traditional and modern processes in real-world scenario.

Modern process of data gathering and analysis is based around information system development project entitled Electronic Data Gathering (Serbian: *Elektronsko Prikupljanje Informacija*, EDG in further text). Project was initiated early in 2008, when RSSEC identified major problems regarding

[3] Extremely time and resource consuming process, which requires usage of special information systems and algorithms (Embley, Campbell, Smith, & Liddle, 1998)

[4] More details regarding Republic of Srpska Securities Commission on the following Web site: www.sec.rs.ba

[5] Positioned in central part of South-Eastern Europe. For more details on country see Wikimedia Inc. article: http://en.wikipedia.org/wiki/ Bosnia_and_Herzegovina

human resource allocation, due to lengthy activities in data processing and analysis tasks. This was due to the fact that RSSEC started receiving large amounts of financial information, so human resources were inadequate for data processing and analysis. Also, the global recession imposed limitations on new employments due to world-wide capital markets crisis. These factors forced RSSEC to rethink the strategy for financial report analysis and, instead of retaining traditional process, to develop brand new information system, oriented towards modern process of data gathering and analysis.

EDG system is in production state since the beginning of 2009, which allowed enough usage time for collection of relevant data regarding process optimization.

This paper analyzes process improvement from traditional to modern process model through the following real-world usage scenarios:

- Report sender perspective (institutions and listed companies)
  - Extracting the financial information from information system
  - Exchanging the data with RSSEC
  - Correcting the data (submitting new versions of data)
- Report receiver perspective (RSSEC)
  - Simple browse of the financial report (all tasks/activities that need to be performed in order to view data)
  - Summarize the data on one specific sender, on yearly basis
  - Create graphical representation of data
  - Online data mining with a pivot table
  - Distribute publicly-available sections of data to RSSEC Web site

Using the above scenarios, this paper will examine how much resources were used[6] for traditional and modern processes. Due to RSSEC limiting the disclosure of confidential financial information, resource usage will be expressed through work hours/employee. Work hours/employee resource usage for report sender perspective is based on experimental test of extracting the data from Microsoft SQL Server database management system by author, simulating the similar scenario on report sender's side.

Report that is being used as an example is constituted of 3 different data entities (tables), containing 10 data columns each, with the relationships to other 6 data entities. Second set of entities are not the financial data itself, but rather data storage entities for various dropdown menus (financial position types, account types, etc.).

Resource usage times for traditional process will be measured with employee who has previous practical experience in analysis process. Also, resource time usage for modern process will be measured with employee who has practical experience in analysis process, or specifically saying, profound knowledge of EDG system. This will eliminate several variables that would otherwise give different measurement results. Some of these variables that are fixed for this research are:

- **Training of employees for financial report analysis**, as an employee would need to have several months of training and at least half-year experience in analysis
- **Training of employees for spreadsheet software/EDG system**, as an employee would need to have course on basic software functions, advanced software functions and probably even a course for basic computer skills
- **Success rate in financial analysis**, as an employee would be either very, moderately or unsuccessful in analysis (correctness of analysis, data interpretation skills, trends identification, etc.)

## 4 ANALYSIS OF RESEARCH RESULTS

EDG system was implemented, as noted before, as means of conforming to modern financial reports gathering and analysis process. RSSEC information system development team undertook a one-year software development project, which produced fully functional data exchange and analysis system. After its initial release early in 2009, system was upgraded with advanced report view functions, charting and business intelligence elements. EDG had implemented several key software architecture elements (as illustrated in diagram 2):

1. Central, relational database management system – for storage of financial reports, based on latest version of Microsoft SQL Server 2005
2. Data processing server – data processing, verification, optimization and statistics

[6]Resource usage is one of the key measurements in analyzing performance of any business process. Project management triangle defines three key factors that need to be managed in any activity/process/project success as following: financial resources, scope and time (Schwalbe, 2006).

3. Business intelligence server – for drill-down analysis and data mining
4. Web front-end server – which provides data exchange interface for financial report senders and data browsing interface for investors/shareholders

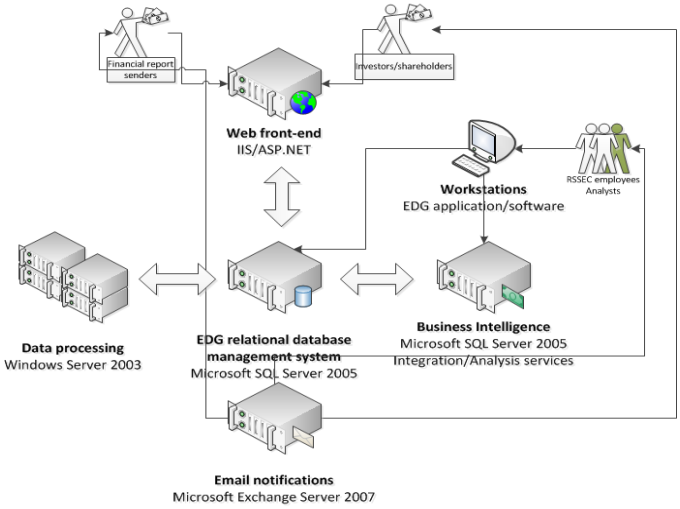


Diagram 2 - EDG conceptual software architecture diagram (source: autor)

5. Email notification server – for various email notifications
6. EDG client application – Windows-based application which provides interface for RSSEC employees who analyze the financial reports

### 4.1 Analysis of results for report sender perspective scenarios

The following table represents measured results for report sender perspective scenarios. *First usage scenario*, extracting the financial information from information system on senders end, saw no improvement in activity count and work hours/employee sum. *Second usage scenario*, exchanging the data with RSSEC, has improvements in number of work hours/employee (60% improvements), with the same activity count. *Third usage scenario*, correcting the data, has improvements in number of work hours/employee (92% improvement), as well as in activity count (60% improvement). Overall improvement in activity count is 33% and in work hours/employee is 44%.

Table 2 - Results for report sender perspective scenarios (source: author)

| | | Activity applicable? | | Work hours/ employee | |
|---|---|---|---|---|---|
| Usage scenario | Activity within scenario | TP | MP | TP | MP |
| Extracting the financial information from information system | Invoking the information system data extraction function | ✓ | ✓ | 0.25 | 0.25 |
| | Basic data verification for integrity and correctness | ✓ | ✓ | 1 | 1 |
| | Exporting the data into required formats[7] | ✓ | ✓ | 0.5 | 0.5 |
| Exchanging the data with RSSEC | Preparation and exchange of data[8] | ✓ | ✓ | 0.25 | 0.5 |
| | Feedback (was data received by RSSEC)[9] | ✓ | ✓ | 1 | 0 |
| Correcting the data | Contacting RSSEC regarding errors in financial report | ✓ | | 0.5 | 0.1 |
| | Identifying which report needs to be corrected | ✓ | ✓ | 0.5 | 0.1 |
| | Organizing the removal of previously submitted data | ✓ | | 1 | 0 |
| | Exchanging corrected data | ✓ | ✓ | 0.25 | 0.5 |
| TOTALS | | | | 5.25 | 2.95 |

### 4.2 Analysis of results for report receiver perspective scenarios

*First usage scenario*, simple browse of the financial report, saw no improvement in activity count, but work hours/employee improved by 90%. *Second usage scenario*, summarize the data on one specific sender on yearly basis, has improvements in both number of work hours/employee (97% improvement) and activity count (66% improvement). *Third usage scenario*, create graphical representation of data, has also improvements in both number of work hours/employee (95% improvement) and activity count (50% improvement). *Fourth* scenario, online data mining with a pivot table, has tremendous improvements in number of work hours/employee (99.9%) and activity count (33%). Overall improvement in activity count is 46% and in work hours/employee is 97%.

[7]Spreadsheet for traditional process; CSV/XML document for modern process
[8]Via email for traditional process; through Web interface for modern process
[9] Manual email reply for traditional process; automated response for modern process

Table 3 - Results for report receiver perspective scenarios (source: author)

| | | Activity applicable? | | Work hours/ employee | |
|---|---|---|---|---|---|
| Usage scenario | Activity within scenario | TP | MP | TP | MP |
| Simple browse of the financial report | Search for specific financial report[10] and browse in adequate application | ✓ | ✓ | 0.5 | 0.05 |
| Summarize the data on one specific sender, on yearly basis | Search for all yearly financial reports for specific sender | ✓ | ✓ | 1.25 | 0.1 |
| | Open all reports and combine data into single data entity | ✓ | | 1 | 0 |
| | Modify the data view, so it's structured on per year basis | ✓ | | 0.5 | 0 |
| Create graphical representation of data | Remove all non-relevant data and select only data for graphical representation | ✓ | ✓ | 0.25 | 0.05 |
| | Apply RSSEC specific charting template | ✓ | ✓ | 0.25 | 0.05 |
| | Save graphical representation into separate document for further usage | ✓ | | 0.1 | 0 |
| | Open all newly received reports (refresh data) | ✓ | | 1.25 | 0 |
| Online data mining with a pivot table[11] | Opel all sender's data for one financial year | ✓ | ✓ | 7 | 0.1 |
| | Combine all data into single data entity | ✓ | | 4 | 0 |
| | Setup pivot table | ✓ | ✓ | 0.25 | 0.1 |
| TOTALS | | | | 16.35 | 0.4 |

### 4.3 Real-world scenario results

Two indicators of improvement, *number of work hours/employee* and *activity count* present process improvement, which unfortunately does not fully reflect the real-world scenario. For the purpose of bringing the reality check into the results, this paper will normalize these results, according to real-world frequency of usage of specific scenarios. This usage frequency model is based on actual statistics of usage of several scenarios/system functions of EDG by RSSEC's employees during 2009.

Real-world frequency of usage (Fu) of these scenarios combined with individual improvement result (Ir) for the total improvement ratio (Tir), by using the following formula:

$$Tir = \frac{\Sigma(Fu_{Scenario\,n} * Ir_{Scenario\,n})}{Number\ of\ scenarios}$$

This formula is combined with previous research results, with the following table of normalized individual improvement ratios and total improvement ration (Tir):

Table 4 - Real-world results for all sets of scenarios (source: author)

| Usage scenario | Frequency of usage (Fu) | Improvement result (Ir) | Individual improvement ratio |
|---|---|---|---|
| Extracting the financial information from information system | 100% | 0% | 0% |
| Exchanging the data with RSSEC | 100% | 60% | 60% |
| Correcting the data | 15% | 92% | 14% |
| Simple browse of the financial report | 80% | 90% | 72% |
| Summarize the data on one specific sender, on yearly basis | 35% | 97% | 34% |
| Create graphical representation of data | 30% | 95% | 29% |
| Online data mining with a pivot table | 25% | 99.9% | 25% |
| TOTAL IMPROVEMENT RATIO (Tir) | | | 33.42% |

## 5 CONCLUSION

Findings of this research, primarily the practical, experimental results, support the theory that, by reducing the number of activities and work hours/employee in the process of data exchange, processing and analysis, organizations can make significant cost cuts. Identified cost cuts of nearly 34% imply that by implementing modern process and information systems for data gathering and analysis, companies can achieve very significant financial benefits. With this cost cut ration, such information systems will return their value in a short time period.

[10]Manual search through collection of files in traditional process; database search by various criteria (date, company name, report type, status, etc.) in modern process

[11] Data mining of all sender's reports for one financial year

This research, however, has purposefully omitted one trend in data exchange information systems in order to focus on some key data gathering and exchange issues. This trend is based on more advanced and mature data exchange systems, which would allow further improvements in first usage scenario. These mature and information technology profound companies have started developing automated exchange systems, which actually allow for automated data extraction and exchange process. However, this process is bound by superb information technology control mechanisms, security and advanced algorithms which would be too complex to analyze and out of primary context for this research.

Further researches would perhaps, having in mind these results, try to model modern process of data gathering and analysis, combined with previously mentioned automated data exchange systems. Also, United States Securities Commission and other financial regulatory bodies recently started to XML-based documents for information report exchange[12], which would be interested to research, since further data dispersion on the capital market regulatory body's Web site would greatly benefit from word-wide standardized data format.

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[12]XBRL – eXtensible Business Reporting Language