

The Informatics Audit – A Collaborative Process

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The paper present issues regarding the audit in informatics field, the audit seen as a collaborative process and how the collaborative banking systems are audited. In this paper, the methodology and techniques for an effective audit process are described. There are highlighted some aspects regarding the assessment of collaborative systems and specific flows of informatics audit.

Keywords: Informatics Audit, Collaborative Process, Collaborative System, Methodology, Banking

1 Audit processes

The audit is applied in financial and informatics fields. A financial audit or an audit of financial situations is the review of the financial statements of a company or any other legal entity, resulting in the publication of an independent report on whether or not those financial situations are relevant, accurate and complete [1]. An information systems audit or informatics audit is the process of collecting and evaluating evidence of a company's information systems, practices, and operations. The evaluation of obtained proofs determines if the information systems are defending the assets of the organization, are maintaining data integrity and security, and are operating effectively to achieve the organization's goals and objectives. These reviews may be performed in conjunction with a financial audit process or other form of attestation engagement. [2]

Increased volume of information and improvement of operating software products have led to a new quality of data use, as an analysis that shows to the organization management the

information difficult or even impossible to obtain in other ways. It is obvious that such information is obtained only by using certain processes, such as multidimensional analysis, some statistical methods of forecasting and other mathematical methods applied to a very large volume of data. These mathematical methods require the use of extremely complex specialized software. [3]

As presented in [4], the audit process in the IT field must be conducted in accordance with the standard specifications in informatics. The auditors must meet the ethical principles and they must have very good professional skills and competence in the IT domain.

The audit objective is to transfer the credibility of the audit team to the audited products, services or processes.

The audit process can be defined like a cybernetic system which start with the analysis of system entries/inputs, continue with the processing of data achieved and finish with the system outputs. This representation of the audit process is shown in the figure 1.

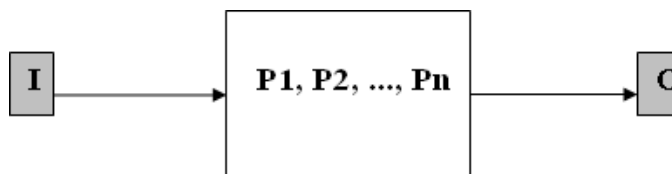


Fig. 1. Audit process representation

The audits can be both reactive and proactive. Some of them are the result of policy changes, the others are conducted at random, to give a statistically valid survey of security stature and compliance of an administrative domain. [5]

In the elaboration process of the audit report, the auditors must have an independent position and

has to be out of interest conflicts, regardless of the beneficiary or the destination of the audit reports. The quality of an audit process is determined by the professional abilities of the auditors. A certified auditor confers value to the audit report. Auditors are responsible whether the audit report is or not ready to the established

deadline. [6]

In [7] is described a tracking and auditing module, which is used to cope with foreseen and unforeseen situations. This module tracks the web usage and fills an interactions repository with these data. Everything can be tracked, both active actions, based on creation of objects, and passive actions, based on visits to objects, and done by the users.

The IT audit department from a bank draw up and update audit programs for information systems and IT applications in the bank. Also, make the audit of newly launched in *live* IT applications and prepares reports from missions conducted. The IT audit department proposes measures to eliminate the deficiencies found, including measures to improve internal control system of the development activities and management of systems and services. The department activity is focused on compliance and security audit of informatics systems and services, evaluating risks / controls within the processes, systems and information services audited.

The objective of audit process is to certify the correspondence degree between the reality and defined criteria. The results are reported to interested people. The audit goal is to increase the quality level through improvement of actions and indicators calculated for the defined quality characteristics. [8]

2 Collaborative processes

Collaborative processes are related to the agents' performance and economic activity. The economic results of one agent influence the performance of the others. [9]

The collaborative systems assessment is an important subject of our days, and a great part of the human activities are involved in this problem. A collaborative system has more agents that work together dynamically. Therefore, it must be flexible in its ability to make transactions. Agents, servers, data warehouses and transactions are all parts of distributed systems in general, but the nature of transactions between agents and the agents shared objectives are what make a collaborative system.

A collaborative system has associated an economic or cybernetic model in order to describe the flows of activities. Choosing an economic model requires that it to be real, relevant and robust, but mostly verifiable. For evaluating the banking system is used the CAPM (Capital Asset Pricing Model) model, typically

used to assess the cost of capital invested.

A banking information system is designed to automate as much of a set of bank's current operations and provide strategic, tactical and operational information necessary in the decision-making process.

Dynamics of collaborative systems concern changes regarding the quality, structure, functions, size, their procedures and standards. Dynamics of collaborative systems are studied using mathematical analysis, providing long-term behavior of each major system, winning a look inside the system design: which parameters determine the group behavior and how the system characteristics are affected.

The informatics audit is a collaborative process in which different auditors cooperate in order to achieve the common goals of the audit process. Each auditor has the prerequisites for developing the audit process, but the auditors can have experience in various activity fields. If they collaborate and exchange their expertise, the audit process will be successful.

In the collaborative process of informatics audit, agents with different backgrounds, experiences and points of view can take part. Nowadays, a collaborative auditing process is scarce on commercial authoring toolkits. Those toolkits just provide a unidirectional vision of creation, edition, viewing and testing of IT field components. [10]

3 Specific flows of informatics audit

The audit in informatics is different and more complex than the audit in accounting, because need specialized auditors in IT field. When applications and systems are audited, the auditors must check that the rules and procedures were respected regarding the development and usage of these software products.

As defined in [11], the informatics audit represents *the analysis and evaluation of a firm's information system to detect and rectify blockages, duplication, and leakage of information. The objectives of this audit are to improve accuracy, relevance, security, and timeliness of the recorded information.*

As presented in [12], the audit process may be conducted by a team with minimal following members:

- a chief auditor certified as information systems auditor (CISA issued by ISACA);
- an expert in penetration tests, certified as Licensed Penetration Tester (LPT) issued by the European Commission Council.

- The audit made for an e-banking system will cover at least the following areas:
- checking documentation opinion;
- identifying and assessing potential risks;
- verification of processes and system workflows;
- checking the procedures for administrator and users authentication;
- checking the security of databases;
- checking the protection of operating system, routers, firewalls and switches;
- verification of antivirus protection;
- checking the backup process, restore and evidence of testing procedures for backup;
- scanning ports and potential vulnerabilities;
- making penetration tests on network equipment, web sites and databases, simulating real attacks both from outside and from inside the network;
- verification of personal data protection and data on bank accounts of a user of the system and the possibility to be accessed by other unauthorized users;
- simulation performance of unauthorized transactions by checking user authentication mechanisms and validation of transactions;
- checking resistance to known attacks, like: Cross-Site Scripting, Cross-Site Request Forgery, SQL Injection, XPATH Injection, LDAP Injection, Malicious File Execution, Insecure Direct Object Reference, Denial of Service, Remote File Inclusion;
- verification and testing of internal data encryption and storage;
- checking weaknesses of the technologies used. [12]

In the audit process, an auditor may request other experts contest, function of the field in which the audit is made and the expertise of each audit team member.

The IT audit department from a bank watch how are implemented the recommendations included in IT audit reports prepared. In this sense IT auditors check, function on risk involved, if that recommendation was successfully accomplished in the deadline established. Drawn up periodically reports regarding the status of implementation of recommendations included in the IT audit reports, reports dedicated to managers of audited activities, to the Executive Committee and Audit Committee.

From case to case, the IT audit department expresses views on the rules and internal procedures, if these views are required, coordinates and develop projects designed to

contribute to the quality of IT audit and the development of effective work tools.

The main activity of the Audit Directorate from a bank is the internal audit. This activity consists of an objective examination of all types of activities and operations realized in the bank, in order to provide to the management an independent opinion on the adequacy, efficiency and effectiveness of internal control system as well as how the risk is managed.

The purpose of Audit Directorate is that, behind these reported audits, the risks to be mitigated and kept within acceptable limits as set by the risk management process.

The Audit Committee acts as the interface in relation with the financial auditor of the bank and is an important element in ensuring transparency in the relationship with the bank's shareholders and holders of bonds issued by it.

Audit Committee members are appointed by the board of the bank, of its members in compliance with legal provisions in force. Audit Committee shall hold meetings every six months or whenever necessary.

4 The audit of collaborative banking systems

The collaborative systems are classified in many categories and there are a lot of criteria for collaborative systems classification. By type and field of application, there are collaborative systems in education, collaborative systems of defense, collaborative banking systems, collaborative functional systems, collaborative micropayment systems, collaborative planning systems, collaborative tagging systems, collaborative writing systems and collaborative medical systems. In [13] a collaborative system for public transport is described, based on multi-source collaborative data inputs from both official and user-submitted sources with the usage of a flexible route-finding application.

The audit of the collaborative informatics systems is a component of the general audit. The responsibility for prevention and detection of the inconsistency and frauds in a collaborative banking system depends on the management staff and security department. This responsibility will be achieved through appliance of an adequate internal control system. This control system is established by management staff in order to make the banking processes orderly and efficiently. Thus, it assures the conformity of the management methods, the protection of the money and the completeness and accuracy of the records in the informatics system. [14]

All the payment transactions made in a bank are stored and processed on multiple servers, so that there is no risk of data loss if the information system falls down. At regular time intervals is performed backup of databases, because people have realized that any loss of information can have serious consequences on the conduct of business organization.

The audit process must be developed in accordance with the audit program. A very important component of the audit of collaborative banking systems is the security controls. For this component, the employees are the central piece in order to protect and keep the system within the designed parameters. [8]

The audit of informatics systems and services that ensure the integrity, confidentiality, availability and relevance of information provided to beneficiaries is made in areas of business. The application and opinions expressed on the effectiveness of risk management procedures and risk assessment methodology are checked.

Banks were undergone to some structural changes, in which the e-banking systems have taken an important role. By developing alternative channels of communication, banks managed to attract more customers, to increase transactions volume, to reduce costs per transaction and thus to obtain a higher profit. Most banks make available to customers services like internet banking, home banking, phone and mobile banking, which contributes to the expanding range of products they offer.

It is considered the case study of a collaborative banking business process regarding the activation of electronic banking services. In this business process, which is a collaborative work, we found two partners: customer and bank. The bank is represented by four entities or departments, like branch, technical assistance, administration and intervention.

In the collaborative banking business process, the bank is represented by four entities or departments: branch, technical helpdesk, server administration and intervention.

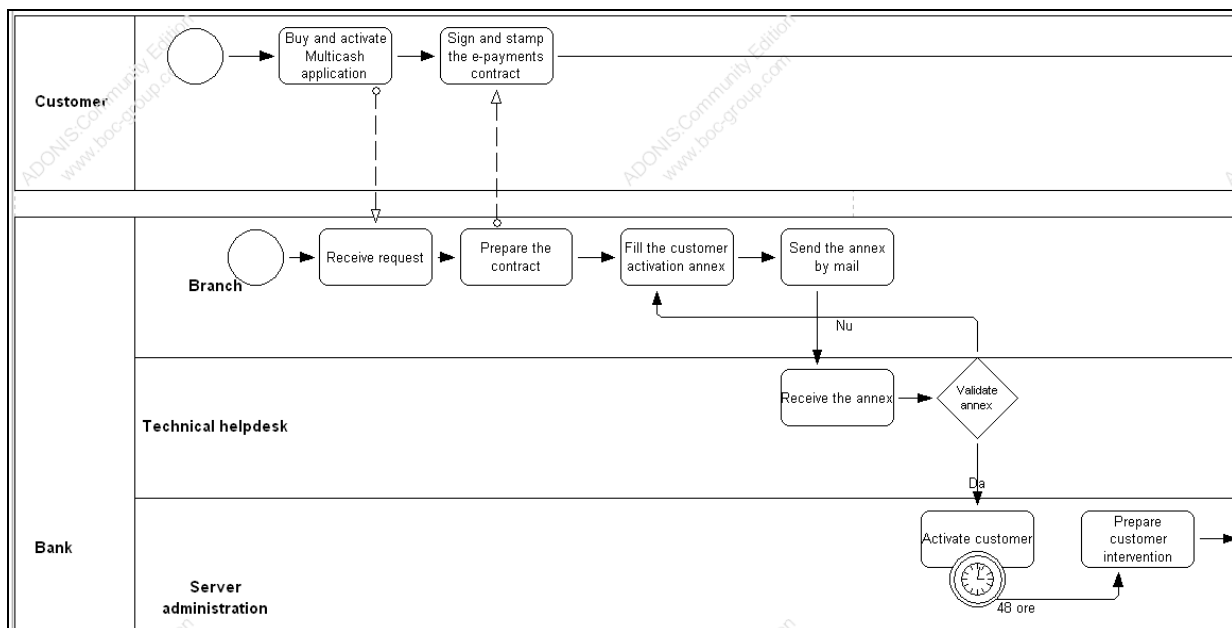


Fig. 2. Collaborative banking business process [15]

In the collaborative banking business process presented in figure 2, the customer and bank agents must cooperate in order to achieve their goals. If the customer wants to make electronic payments, he must buy and activate the Multicash application. For doing this, he will sign and stamp an e-payments contract. The bank branch will receive the activation request, will prepare the contract, fill the customer activation annex and send it by mail. The bank technical

helpdesk will receive the customer annex, validate it and if everything is good, the bank server administrators will activate the customer and prepare the intervention for installing the application.

This is a collaborative process in which many agents work after strict rules and procedures. If an agent will do a mistake, everything will be destroyed. [15]

Collaborative banking systems differ one from

each other by complexity of their applications. The complexity problem is made similarly to the problem of simplicity. The complexity of collaborative banking systems is a new concept that requires a rigorous definition in order to measure the level of complexity and to compare the systems.

The banking system is collaborative by its organization and definition. In a bank the collaboration it is at all structural levels. From organizational point of view, there is collaboration between departments, but also between central bank and its branches.

From informatics point of view, software applications collaborate and are integrated into an

information system. An electronic payment application works together with the application for transactions processing and settlement and with the application for rejections monitoring. If any of these three applications is not working, then the customers fail to make payments. Collaboration at the level of a bank's information system is more efficient by integrating several applications of the system.

There are considered the collaborative banking systems S_1, S_2, \dots, S_n , including the information systems SI_1, SI_2, \dots, SI_n . For each information system are identified the values of indicators in the table 1.

Table 1. Indicators values of information systems

Information System	Complexity	Achievement Duration	Achievement Cost	Length by number of conventional instructions	Number of persons involved
SI ₁	C ₁	D ₁	K ₁	L ₁	N ₁
SI ₂	C ₂	D ₂	K ₂	L ₂	N ₂
...
SI _n	C _n	D _n	K _n	L _n	N _n

Increasing the collaborative level of banking system is achieved through the use of metrics for determining the levels of quality characteristics in order to identify new situations of collaboration.

Following the analysis of indicators values for the n information systems from the table 1, are established the correlations:

$$D = a * C + b,$$

$$K = d * C + e,$$

$$W = m * C + n,$$

$$W = L / N,$$

where:

- C – the average complexity level;
- D – the estimated achievement duration;
- K – the estimated achievement cost;
- W – the estimated labor productivity;
- L – the average length given by number of conventional instructions;
- N – the average number of persons involved;
- a, b, c, d, e – coefficients.

When a new information system is designed, must be identified the class to which it belongs. The class at which belongs the system indicates its complexity.

Having the complexity value and the estimated model, will be obtained the estimated achievement duration, the estimated achievement cost, the average length given by number of

conventional instructions, the average number of persons involved, the estimated labor productivity, the specification of labor productivity. Data from the specification provides a image of the reuse of certain system components.

Starting from the information systems SI_1, SI_2, \dots, SI_n , on must see what can be reused when the new system will be designed. By reusing certain components of existing systems will be minimized the achievement cost of the new system:

$$KU = \min(x, y),$$

where:

- KU – the estimated achievement cost per 100 lines of source code;
- x – the number of source code lines with maximum reusability degree;
- y – the number of source code lines with minimum reusability degree.

The achievement cost of the new system was defined as minimum between the number of source code lines with maximum reusability degree and the number of source code lines with minimum reusability degree.

5 Audit methodology and techniques for collaborative systems

Before starting the audit process, an auditor needs to understand the strategy that the

organization is following and where the organization is along its objectives.

Informatics audit services at major auditing organizations are based on and structured around industry. The auditors need to understand this and the audited organizations need to appreciate their responsibilities to partner with their auditors to explain how their systems meet the fundamental requirements underlying the audit objectives.

As such, the auditors in the informatics area need to understand the potential changes in their client's IT environment in order to appreciate how the goal of maintaining effective internal controls has shifted. This is very important to the success of an effective and relevant audit.

Informatics audit is about the formal verification and validation of the quality and effectiveness of IT controls to support the overall business control objectives. [16]

As presented in [17], the audit methodology help the auditor to choose the appropriate audit approach, which can be *system based* or *direct substantive testing*. In the system based approach, aspects of regularity, economy, efficiency and effectiveness of the audited system have to be looked into besides evaluating data integrity and security. In the case of direct substantive testing approach, a sample of transactions should be selected and tested.

The selection of one approach or another is based on the followings:

- the results of the preliminary evaluation of the audited system;
- the measure in which reliance can be placed on any work carried out by internal audit;
- effective compliance testing of key computer

controls;

The audit techniques in the informatics field refer to the use of computers, including software, as a tool to independently test computer data of audit interest. There are used the following techniques in the collaborative systems:

- collecting and processing a set of test data that reflects all the situations in which data and errors can arise in an application system at different times;
- using integrated test facilities, built into the system by the audited organization to help the auditor in his requirements, as one of the users of the system;
- simulating the collaborative system programs using audit software to verify the results of processing;
- reviewing program listings periodically to check if there are no unauthorized alterations to the programs;
- using either bought software or in-house developed programs to interrogate and retrieve data applying selection criteria and to perform calculations with these values;
- extracting samples of data from the audited organization database, using sampling techniques, for further analysis and review. [17]

Collaborative systems are efficient and achieve results accurately and completely if they work the way they are designed to.

In the audit process of an application, represented by Collaborative Multicash Servicedesk, used in a bank in order to manage the customers' problems regarding the Multicash electronic payments software, the followings specifications are considered in the table 2.

Table 2. Audit specifications of Collaborative Multicash Servicedesk application

Specification	Planned	Realized	Difference
Number of admin users	2	1	1
Authentication levels	2	2	0
Number of requests categories	2	3	-1
Waiting time for a request in order to be solved	3	1	2

The difference between the planned level and the realized level must be near to zero in order to show equilibrium of what the application was planned to do and what is effectively doing.

In order to measure the quality of a collaborative system, represented by Collaborative Multicash Servicedesk application, and assess its performance was used the indicator:

$$Q = p_1 * \frac{\min(x, y)}{\max(x, y)} + p_2 * \frac{\min(z, w)}{\max(z, w)},$$

where:

x, z – the planned values for two quality characteristics;

y, w – the realized values for two quality characteristics;

p_1, p_2 – the share of each quality characteristic ($p_1 + p_2 = 1$).

For characterization and classification of a collaborative system into a certain category in terms of complexity, reliability, portability and

maintainability, will be determined an indicator of metric refinement, applied to that system. The metric refinement indicator I , of a system in the case of four influence factors, is calculated according to:

$$I = \frac{\min\{a,b,c,d\}}{\max\{a,b,c,d\}},$$

where:

- a – the complexity level;
- b – the reliability level;
- c – the portability level;
- d – the maintainability level.

The metric refinement indicator takes values between 0 and 1, the 0 value showing the best results.

In the case of Collaborative Multicash Servicedesk application, the maximum complexity value of the application is 10, the reliability indicator is 0.95, the value obtained for

the portability indicator is 0.70 and the value of the maintainability indicator is 0.85.

Depending on the values calculated for the four indicators, was obtained a value of 0.07 for the metric refinement indicator. This value is very good and proves that the Collaborative Multicash Servicedesk application needs minor changes in order to be refined from the point of view of influence factors.

For a bank in Romania, using the Multicash software as an electronic payments system, was made an audit in order to see which are the categories of customers requests and which is the apparition frequency in a period of time. The results obtained for the January 2010 are shown in the table 3, where are presented the problems that the customers complained to the bank and the number of times they appear.

Table 3. The problems claimed by the Multicash software users

Request category	Frequency
Add new accounts in the client application	31
Add new users in the client application	37
Other requests	135
Payments cancellation	6
User blocked on the communication	58
User blocked at logon	39
Communication initiated	47
Confirm account balance	107
Deactivate payments file	3
Error on starting the application	15
Signature error	49
Error on see statements	52
Statements export	9
Generate electronic signature	33
Index corrupted in database tables	8
Installing the application abroad	5
Training on using the application	29
Training on see rejected payments	15
Intervention of service provider	4
Delivery account statements	23
Delivery file with bank codes	20
Delivery files for distributed signature	6
Login with admin2 user	2
Change communication channel	1
Change number of approvals / amount limits	1
Change name / address of payer	6
Move the application on another computer	13
Please repeat job with AC29	8
Communication problems to the customer	4
Reinstalling the application	21
Setting print parameters	5

Setting communication sessions	4
Training of branches for completing annexes	17
Transmission interrupted	37
Change the customer status in LIVE/ TEST	1
Check payments status	172
Check the import file structure	2
Check the validity of files sent for distributed signature	1
Total	1026

The bank management check this situation monthly in order to see which are the most frequently problems of the customers and how these problems can be minimized. Also, this report is used by the IT department for establish further improvements of the Multicash software.

6 Conclusions

In a bank, all the information systems are collaborative systems, because they require the cooperation, communication and coordination of many software applications in order to achieve a common goal. This common objective can be represented by the successful processing of a payment order or by the interest calculation of a term deposit.

The bank's information system is very complex and very clever, because it must manage customer accounts and money. The bank existence to the market is limited in functionality and maintainability of its information system. The importance of the banking information system audit is very high and the collaborative audit processes must be lead by persons with high level of professional competencies and skills. They follow the standards, guidelines, procedures and legal requirements to evaluate collaborative informatics systems. [6]

The audit of collaborative systems allows their quality characteristics evaluation. The assessment is made by independent people who must have a very good professional background in order to manage the audit process. The audit results must correct some aspects concerning the development of collaborative systems. [8]

The environment in which collaborative systems carry out their activities is dynamic and constantly changing. The agents have a vast interest in utilizing and developing a model that will allow them to evaluate the performance of a collaborative system. [18]

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