Framework for Evaluation of the IT&C Audit Metrics Impact

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The paper defines an assessment system for performance of IT&C audit process. The analytical models of performance indicators are provided together with the interpretation of their results. Performance levels catch the quality characteristics of the audit processes carried out for distributed informatics systems. Also, the paper presents a performance assessment framework for audit processes and a performance audit methodology. The impact of performance indicators is defined as the organization's income after performance audit recommendation implementing. Methods and techniques for performance assessment are provided for audit processes of the distributed informatics system. The impact levels of performance indicators are calculated before implementation of the performance recommendation and after that to establish whether the performance audit increases the quality of IT&C audit processes.

Keywords: *Performance Metrics, Metric Impact, Audit Process*

1 Performance Quantitative Methods for IT&C Audit Process

The quality of the IT&C audit processes [2], [4], [5], [6], [7], [8], [9], [10] and [11] is determined by reviews of this kind of process. The goal of the audit process measurement is to produce information for the people who performs audit investigation of products, services, systems or processes. Thus, opportunities to improve IT&C audit process are identified and contribute to meet the goal of the audit team.

Indicators for IT&C audit process assessment are quality indicators. They are applied to compare separate audit processes made by the same team or different audit teams. A quality indicator must eliminate factors that characterize a product, service, system or process like the size of these audit objects.

Meeting the IT&C audit process goals is established by the following indicator [8]:

$$I_{SG} = \frac{NAG}{NPG}$$

where:

- I_{SG} is indicator to assess the meeting of goals; it takes values within [0; 1]; value 1 means that all goals are met, and null value means that the audit team has not reached any goal;
- NAG represents the number of accomplished goals after IT&C audit process finish;
- NPG represents the number of planned goals established in the audit program when the process starts.

Regarding the schedule and progress indicators category, the following can take it into consideration [8]:

$$I_{PM} = \frac{NAM}{NPM}$$

where:

- I_{PM} is indicator to assess the accomplishment of milestones; it takes values within [0; 1]; value 1 means that all milestones are accomplishment in time, and a null value means that the audit team has not accomplished any milestone in time;
- NAM is the metric for number of accomplished milestones;
- NPM is the metric for number of planned milestones established when the IT&C audit process starts.

When the value of I_{PM} is less than 1, it means that the audit team cannot deliver the planned results when they planned the audit process. This issue will lead to cost increasing of the

audit process and deadline exceeding. Thus, the audit client satisfaction reduces as the work quality of the audit team.
After audit process finish, the audit team must analyze the causes of milestone unaccomplishment to avoid the customer's dissatisfying and to increase the work quality of the audit team. The causes can be objective and subjective. By analysis, the audit team must identify the corrective actions for subjective causes and avoidance of the objective ones for the next audit processes.
The above indicator can be implemented when the IT&C audit process is organized as a project, meeting all the specific requirements of project management.
A version of I_{PM} indicator is defined to emphasize the measure of exceeding the milestones deadlines. The mathematical model is [8]:

$$I_{TMP} = \frac{\sum_{i=1}^{NPM} tmp_i}{PT}$$

where:

- I_{TMP} is indicator to assess the time exceeding of the milestones; the calculated value means the degree in which the time allocated to audit process must be increased to get the planned results; a null value of I_{TMP} means that all milestones were timely accomplished and the audit process is finished at planned time;
- tmp_i is the metric for time measuring; the measure unit is days or hours, depending on time allocated for audit process or values of tmp_i;
- NPM is the metric for number of planned milestones established when the IT&C audit process starts;
- PT represents the planned time for audit process finish; it has the same measure unit like tmp_i.

I_{TMP} indicator is used by audit team to establish the deadline and budget extensions of audit process. If the value of this indicator is very large, then it is possible to stop the audit investigations because there not funds or time to obtain appropriate information needed by management.
The audit team effort to implement an IT&C audit program can be calculated as [8]:

$$I_{WE} = \frac{\sum_{i=1}^{NAT} \sum_{j=1}^{NATA} tme_{ij}}{WPT}$$

where:

- I_{WE} is indicator to assess the audit team effort as working time to implement the activities planned in audit program; a value of I_{WE} less than 1 means a better use of working time or an overrating of the planned work volume; a value of I_{WE} greater than 1 will lead to increasing of indicator I_{PM} or a poor rating of the work volume within audit team;
- tme_{ij} is the metric that measure the time expressed as days or hours in which the audit team member *i* works to accomplished the allocated task *j*;
- NAT represents the number of audit team members or other specialists involved in IT&C audit process for its accomplishment;
- NATA represents the metric for number of the tasks allocated for audit team member *i*;
- WPT is the metric to establish the planned time for entire audit process allocated for team members working.

Indicator I_{WE} provides information to audit team regarding the time needed to implement the activities of the process by its members and external specialists. The working time can differ from a specialist to another one for the same activity. Thus, use of some statistical methods and techniques is required to establish the planned working time closer to the reality.
Also, the above indicator can be used to establish the audit team volume as number of members. So, the quality of the IT&C audit process increases when the audit team members are in a small number and they implements the audit program based on their knowledge, competencies, skills and work experience. This issue will lead to better re-

sults and smaller budget allocated for audit process.

The economic issue of the IT&C audit process is emphasized by the indicator [8]:

$$I_B = \frac{IC}{PC}$$

where:

- I_B is the indicator for calculation of the quality for funds spending; a value of I_B less than 1 means an efficient use of the budget; if I_B is greater than 1, then costs are greater than the planned ones;
- IC is the amount for real costs of audit implementation;
- PC is the metric to quantify the amount of planned costs before audit implementation;

This indicator can be calculated during the audit process and after the audit process finish. I_B is calculated during the audit process implementation to control the budget within acceptable limits. The audit customer can impose a superior budget limit as criterion to stop the audit investigations. The reasons aim the financial resources of the audit customer, opportunity of the audit information or other technical and social requirements.

The customer satisfaction can be quantified by the number of audit processes ordered to the same audit team or organizations that perform audit investigations. The prestige of the organizations that perform audits depends of number of audit customers and the size and market shares of audited organizations.

Another way to quantify the customer satisfaction is made during the audit process. The indicator has the following mathematical model [8]:

$$I_{CS} = \frac{STAC}{TTAP}$$

where:

- I_{CS} is the indicator for calculation the satisfaction of audit customer; it takes values within [0; 1]; when the I_{CS} takes the value 1, the audit team has the total support of the audit customer to accomplish the goals of the audit program;
- STAC is the metric for quantifying the support time of the audit customer for entire audit process or the time elapsed from beginning moment until the calculation moment;
- TTAP is the metric for quantifying the total time allocated to audit process or the total time elapsed from audit beginning until the moment when I_{CS} is calculated;

An audit team or audit organization can evaluate the quality of the performed audit process calculating the above indicator.

Regarding the audit object, the work quality of the audit team members is established by requirements covered by standards used as assessment criteria.

The indicator used to calculate the covering of standards requirements by audit object is [8]:

$$I_{RC} = \frac{\sum_{i=1}^{NS}\sum_{j=1}^{NRQ} arq_{ij}}{\sum_{i=1}^{NS} rq_i}$$

where:

- I_{RC} is indicator for covering the standards requirements by audit object: product, service, system, process; the possible values are within [0; 1]; when I_{RC} takes value 1, that means audit object accomplishes all the requirements of the standards which the audit team included them in the audit program;
- arq_{ij} takes only one from the following values: 0 or 1; it takes the value 1 when the requirement *j* specified in standard *i* is accomplished by audit object;
- rq_i represents the number of requirements used in audit process and specified in standard *i*;
- NRQ is the metric which provides the number of requirements from the standard *i* taken into consideration by audit team;
- NS is the metric which provides the number of standards used in audit process.

The covering of the standards requirements can be complete or incomplete. If the covering is incomplete, the indicator I_{RC} contains unknown information which it cannot say anything. It is necessary to separate the valuable information from the unknown information to formulate an objective opinion about the audit object.

The IT&C audit processes are developed to improve the ways in which the audited organization meets the organizational goals.

The effects of recommendation applying can be quantified by the next indicator [8]:

$$I_{AVE} = \frac{\sum_{i=1}^{NVP} av_i}{NE}$$

where:

- I_{AVE} represents the indicator for calculation of the added value average; it can take negative values or greater than 0 values;
- av_i is the metric that emphasizes the added value resulted from a process changed in accordance with the audit report recommendations;
- NVP represents the number of processes that generated added value for the audited organization;
- NE represents the metric that shows the number of employees within organization that implemented the audit recommendations.

A higher value of the I_{AVE} means a high quality of the audit process. The indicator can be used to compare the effects of more audit processes. Thus, a comparative quality analysis can be implemented to emphasize the factors influencing the quality of an audit process.

A revised version of indicator I_{AVE} is stated as [8]:

$$I_{CAVE} = \frac{\sum_{i=1}^{NVP} av_i - IC}{NE}$$

where:

- I_{CAVE} means the revised form of I_{AVE};
- av_i has the same means like av_i for I_{AVE};
- IC represents the metric emphasizing the amount for real costs of audit implementation;
- NVP has the same meaning like I_{AVE};
- NE represents the number of employees within organization.

The added value obtained after implementation of the audit recommendations does not consider the effects of other changes implemented within organization and changes of the organizational environment like laws regulation.

An organization will select the audit team or organization with the best results in the field where it wants an audit assessment, taking into consideration the similar audit object. A selection criterion can be the indicator I_{AVE} or I_{CAVE}.

Another version of IAVE aims the average of added value on audit team member [8]:

$$I_{CAT} = \frac{\sum_{i=1}^{NVP} av_i - IC}{NAT}$$

where:

- I_{CAT} is the indicator for calculation of the added value average on each audit team member;
- NAT is the metric emphasizing the number of audit team members or other specialists involved in audit process;
- av_i has the same means like av_i for I_{AVE};
- IC represents the metric emphasizing the amount for real costs of audit implementation;
- NVP has the same meaning like I_{AVE}.

For an organization is better to implement an audit process with audit team having the best value for the indicator I_{CAT}.

The efficiency of the audit team can be evaluated by the indicator [8]:

$$I_{EAT} = \frac{\sum_{i=1}^{NVP} av_i - IC}{IC}$$

where:

- I_{EAT} is the efficiency indicator of the audit team;

- av_i has the same means like av_i for I_{AVE};
- IC is the same metric like I_B.

I_{EAT} shows the added value by each unit of cost to carrying out the audit process.

A version of the above indicator considers the market share of the audited organization before and after implementation of the audit recommendations. The indicator has the following mathematical model [8]:

$$I_{EMS} = \frac{NMS - OMS}{IC}$$

where:

- IEMS means the efficiency indicator of the audit team;
- NMS represents the metric emphasizing the market share of the organization after the implementation of the audit report recommendations;
- OMS represents the metric regarding the old market share of the organization before the audit process;
- IC is the same metric like I_B.

Another quality indicator for audit team evaluation is productivity of the audit team, having the model [8]:

$$W_{AT} = \frac{\sum_{i=1}^{NG} ag_i}{TTAP}$$

where:

- W_{AT} means the productivity of the audit team;
- ag_i represents one goal from the audit program;
- NG is the metric which shows the number of goals for the audit process;
- TTAP is the metric for quantifying the total time allocated to audit process.

The indicator W_{AT} is used to select the most effective audit team or auditors. This issue leads to better results both the audited organization and organization which performs IT&C audit processes.

Decisions regarding the IT&C audit process can be taken on the above quality indicators. The goal of use them is to increase the quality of the activities carried out during the audit investigation. Also, the quality indicators predict future audit process trends.

The quality indicators of IT&C audit processes aim the following issues:

- Better planning and resource allocation within IT&C audit portfolios;
- Identifications of audit process weaknesses and assessment of the changes.

A successful IT&C audit process assessment depends on the following elements: model, measure and management.

2 Issues of Metric Impact Assessment for Audit Process

Identifying the effects of a performance audit of IT&C audit process is a complex and challenging task. The reason is given by the fast evolution of the IT&C technologies used in the more complex distributed informatics systems. The main objective of developing a performance audit of IT&C audit process is to find the way to improve the efficacy and effectiveness of the audit programs.

Metric impact assessment for audit processes has to be able to provide a mechanism that evaluates the response of an audit process to measures implemented on conclusions of the performance audit. A metric impact assessment helps the managers of the audit process to understand the possible effects in future impact assessments of related IT&C audit processes.

In an impact assessment, both qualitative and quantitative methods are used. Qualitative methods estimate the potential of impacts generated by performance audit, mechanism of such impacts and extensions of the benefits. Quantitative methods evaluate the possible outcomes when the performance audit is changed and measure the impact after performance carrying out.

Evaluation of the IT&C audit processes has the following approaches, adapted from [3]:

- Monitoring – tracks the key indicator progress during audit process to evaluate outcomes of the intervention; goals, indicators and targets are established; the results are used to assess the IT&C audit performance;

- Operational evaluation – determines the effective degree of the audit process implementation and the differences between the planned and performed outcomes; it is a systematic and objective assessment of the audit process; the goal is to ensure an effective implementation of the audit process according to the audit plan;
- Impact evaluation – establishes whether the improvements are the result of the intervention in audit process and not to other factors.

The metric impact assessment for the system presented in a previous chapter is made before and after implementation of the recommendations included in the performance audit report. The quality of the recommendations can be assessed comparing the two values of the same indicator before and after applying of the recommendations.

After the performance audit of the IT&C audit process, an initial impact assessment can be made. This assessment is made before the implementation of the performance audit recommendation and quantifies the expected level of impact. After implementation of the recommendations, a new assessment based on defined indicators is made and it is quantified the real level of the impact. The main challenge is to quantify the impact level of the implemented recommendations and elimination of other factors.

The impact level of the performance indicators to IT&C audit process is a part of the improvement effects of the performance audit to the whole audited information system. Figure 1 depicts the net impact level as result of a performance audit investigation.

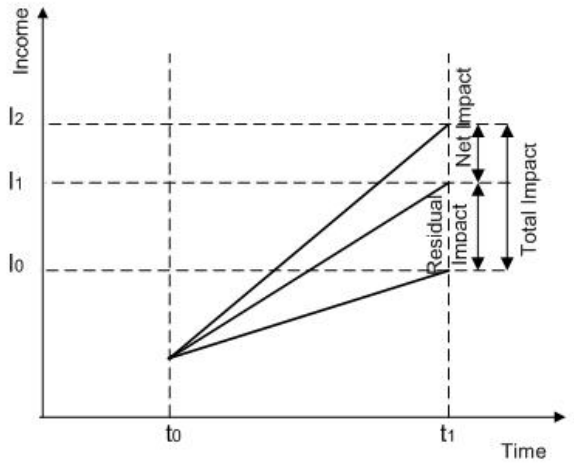

Fig. 1. The net impact level on audited information system

The audit process impact can be assessed on the organization income after implementation of audit report recommendations. A part of the income increased is due to the performance audit. A performance audit increases the quality of IT&C audit process. A better quality of IT&C audit process means an increased quality of audit process recommendation.

It is hard to identify the impact of the performance audit on IT&C audit process and the effects assessed in income. It can be calculated when all other IT&C factors do not change in the $[t_0; t_1]$ interval. As measure, the net impact is calculated as $I_2 - I_1$ and it is equal to $I_2 - I_0$ when there not other factor to be considered.

The metric impact assessment is made on performance indicators defined and built in a previous chapter.

The performance audit is based on performance measures that are quantitatively determined to provide an image of IT&C audit process carrying out. They are used to understand, manage and improve the IT&C audit process. The performance recommendations

applied in IT&C audit process are quantified to evaluate the performance indicator impacts. The impacts are considered on the following levels:

- Performance indicators of the IT&C audit process;
- Performance indicators expected before implementation of the performance audit recommendations;
- Performance indicators quantified after implementation of the performance audit recommendations.

Effective performance indicators highlight, adapted from [1]:

- Quality of the process activities;
- Goal accomplishment;
- Audit client satisfaction;
- Statistical control of the process;
- Improvements to be implemented.

The study of performance based on impact metrics in IT&C audit processes is made on the following performance assessment framework, adapted from [1]:

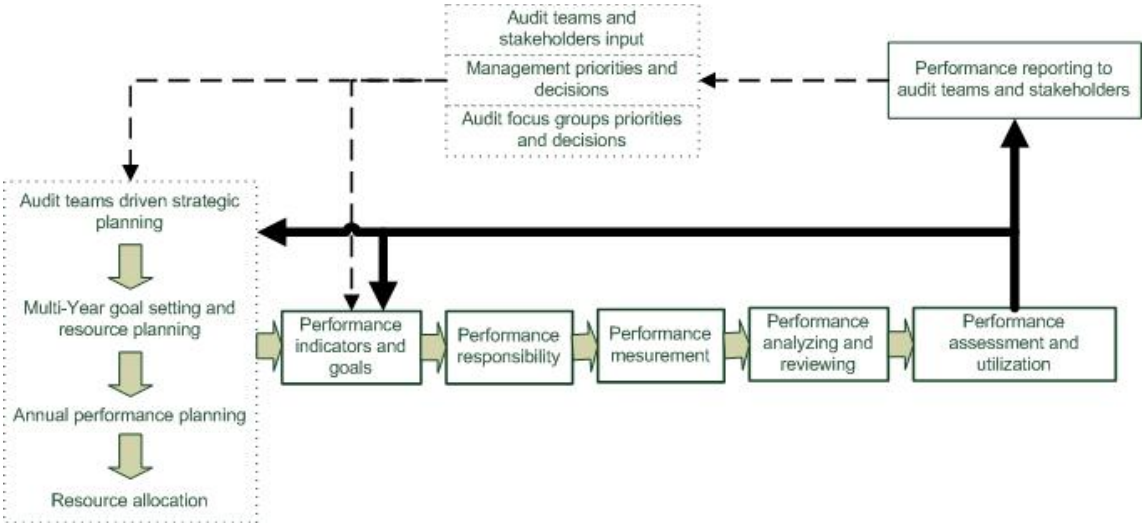

Fig. 2. Performance assessment framework for audit processes

The above performance assessment framework highlights the performance measurement stages and the life cycle of such quality investigation of audit processes.

The performance assessment stages are, adapted from [1]:

- Performance planning – the following actions must be considered:
  - Mission is clear and energizes the audit team;
  - Goals and objectives are focused;
  - Goals and objectives have owners;
  - Strategies are developed and resources are allocated;
  - Addressing the audit team needs;
  - Defining the outputs and outcomes;
  - Using the decision issues and processes;
- Establishing and updating the performance indicators and goals – are implemented by the following activities:
  - Supporting the management culture;
  - Using the goals as source for indicators;
  - Exploring the common indicators;
  - Using the performance management tools;
  - Mapping the performance indicators to audit process;
  - Interpreting the performance levels;
- Establishing the performance responsibility – aims the following issues:
  - Indicator ownership and necessary resources;
  - Establishing responsibilities for data collection, reporting, analysis and posting;
  - Performance assessment is made by managers;

  - Development a reward system clear and consistent, according to the performance levels;
- Data collection and reporting – consist of the following activities:
  - Identifying the data sources;
  - Information systems permit data collection and reporting;
  - Conducting pilot tests;
  - Using requests for updating;
  - Documenting the methods and techniques for data working;
  - Following data definition for common indicators;
  - Ensuring data quality characteristics like reliability, timeliness, accuracy, rapid access and confidentiality;
- Performance analyzing and reviewing – are provided by:
  - Integration of data;
  - Development the analytical capabilities;
  - Analyzing the validation of results;
  - Reviewing the results faced to expectations by the management factors to make some corrections;
  - Ensuring the continuous improvement by feedback to activity or process owners;
- Performance assessment and utilization – is characterized by:
  - Using the performance to improve the audit processes;
  - Displaying and publication the results to audit teams and stakeholders;
  - Rewarding and recognition based on performance results;
  - Benchmarking and comparative analysis with other audit processes;
  - Updating the performance process goals and indicators;
  - Identifying information for reengineering and resource allocation.

The performance indicator levels are reported to the audit teams and stakeholders. The last ones update the audit processes to improve the quality evaluation of the distributed informatics systems. The new inputs and goals will redefine the audit process development environment. This fact will lead to a new cycle of performance audit for information systems. Also, the goal and indicator updating are directly made on the performance information provided by the performance audit teams.

Performance indicators are represented by single-dimensional units or multi-dimensional units. The last type of performance indicators provides more information about the analyzed process.

A performance assessment system has the following reasons to be built [1]:

- Provides many benefits for an organization like a structured approaching, a reporting system to the upper management;
- Concentrates resources to achieve the objectives;
- Improves the management and delivery of products and services;
- Improves communication among employees, between organization and its customers and stakeholders;
- Justifies programs and their costs;
- Addresses the needs of the society;
- Improves government management;
- Reduces emotionalism and encourages problem solving;
- Increases influence in the areas needing attention and influences the employee performance;
- Is absolutely necessary to make improvements.

Metric impact assessment provides information regarding the IT&C audit processes that aim the following issues, adapted from [1]:

- Accomplishment of the IT&C audit process goals and standards;
- Detection and correction the problems of the audit process;
- Management, description and improvement of the audit process;
- Document accomplishments;
- Evaluation of the efficiency and effectiveness of the IT&C audit process;
- Fulfillment of the audited organization vision and meeting the organization's

goals;
- Progress regarding the accomplishment of the IT&C audit process goals and standards.

Limitations regarding the performance indicators [1]:
- The cause and effect of outcomes are difficult to be established – to assess the impact, it is necessary a in-depth analysis to determine why the effects are positive or not; also, in IT&C audit processes, implementation of performance audit recommendations can lead to unexpected outcomes;
- Lack of performance does not mean a poor execution – the performance indicators does not always indicate the reasons for lack of performance;
- Defective processes are not fixed by numerical values – the numerical values of the performance goals does not indicate the improvements to be made to accomplish them;
- Indicators only approximate the system in operation – the system can hide the lacks of valuable components; also, data may not be accurate or available;
- Performance indicators do not ensure compliance with laws and regulations – the indicator values do not provide information regarding the adherence to laws and regulations.

The metric impact assessment can fail when the performance indicators are calculated considering the following issues [1]:
- Information overloading – there are too much data so that they are ignored or used ineffectively;
- Focusing on the short-term – long-term performance indicators are not considered;
- Business decision-making process based on intuition and experience – validated data are not considered to make business decisions by managers;
- Using meaningless data – data are not reported clearly and understandably;
- Using little data – it is the reverse problem for decision-making based on intuition and experience; too few key indicators are calculated to see the whole image of the organization;
- Using inconsistent, conflicting and unnecessary data – the indicator values are not accurate, leading to wrong decisions based on these indicators;
- Driving the wrong performance – a very good performance indicator in one area can decrease the performance in another one or overall system;
- Encouraging competition and discouraging teamwork – comparing the performance indicator can lead to a stronger competition between employees or organizational units and destroying the sense of teamwork;
- Indicator fitting into constraints – it is due to unrealistic or/and unreasonable indicator values; constraints aim the cost-effective of the budget and personnel; also, the indicator values must be achievable;
- Lack of indicator links – indicators must be linked at horizontal and vertical strategic plans of the organization; without linkage, an indicator is useless;
- Measuring progress – if the measuring progress is too often, then the cost are excessive and the effort is unnecessary; if the measuring progress is not often enough, then the management does not know the potential problems to be approached in shortest time;
- Ignoring the customer – the performance indicators must follow the customer's satisfaction over the all organizational processes;
- Wrong questions and wrong places – performance indicators calculated on data collected from wrong people or wrong places;
- Confusing the purpose of the performance indicator system – the purpose of the performance indicator system is to refine and use data for decision-making processes leading to process improvements.

Comparing the performance indicator values between IT&C audit process before and after performance audit, it assesses the impact

measures of the recommendations. An example of impact measure is the comparison of the actual outcome with the estimated outcome or with the outcome before the implementation of performance recommendations.
The impact indicator values are difficult to be calculated because there are many variables contributing to the IT&C audit process outcome.

3 Methods for Performance Evaluation of IT&C Audit Process

Evaluation of IT&C audit process is faced with many complex issues. To extract objective and valuable information from evaluation process of IT&C audit, the process evaluators must have skills in analyzing activities and management practices. Some issues of audit process evaluation are standardized, but it is not possible to cover all kinds of audit processes. There are different approaches, methods and techniques to evaluate the performance of the audit process.
Evaluation of IT&C audit process aims efficiency and effectiveness of the process performed by economy and improvements. The main reason to perform an evaluation process of IT&C audit is for a better spending of money for audit process development. The activities included in evaluation process are, adapted from [12]:

- Audit of the economy of audit activities, respecting the audit principles and practices, and management policies;
- Audit of the efficiency of resource utilization: human, financial and material resources; the following activities are performed: examination of IT&C systems, performance measures, procedures followed by audited team;
- Audit of the performance effectiveness; the goal is to establish the achievement degree of the objectives and the actual impact versus the intended one.

The challenges of the evaluation process for an audit process are [12]:

- The things are performed in the right way – the rules and requirements are applied during the audit process by the audit team leader;
- The right things are performed – the appropriate activities are carried out by the audit team.

The criteria to evaluate the IT&C audit process are, adapted from [12]:

- Economy – a goal of performance evaluation of audit processes is to keep the costs low; it is difficult to establish whether the acquisition funds are economically used and the quantity and quality of the acquisitions are optimal; to establish the achievement of this criteria, the evaluation process must investigate the following issues:
  - Acquisition costs of the equipments used in IT&C audit process;
  - Economy of utilization for human, financial and material resources during the IT&C audit;
  - Performing the IT&C audit management activities according to management principles and policies;
- Efficiency – it concerns the optimal use of resources used during the IT&C audit process; resources are optimally used whether the obtained output of audit activities is maximum that it can be; it is highlighted the relation between the costs of performed resources and activities and the quality and quantity of the audit results; evaluation of the audit process efficiency must take into consideration the following issues:
  - Efficient using of human, financial and material resources during the audit process;
  - Efficient management, regulation, organization, execution, monitoring and evaluation of the audit programs, processes and audit teams;
  - Objective and requirements are established for audit processes;
  - Audit processes are characterized by good-quality, audited organization-oriented and right-time delivering;
- Effectiveness – it aims to achieve the goals or objectives of the IT&C audit process; the analysis of goal achievement compares the outcomes with the goals established in the IT&C audit ob-

jective; evaluation of the audit effectiveness is implemented by the following activities:

- Assessment of audit program – it must be effectively, clearly and consistently prepared and designed;
- Effectiveness assessment of audit objectives and means – they have to be proper, consistent, suitable and relevant;
- Effectiveness assessment of organizational structure, decision-making process and management system within the IT&C audit team;
- Assessment of audit supplements, duplicates and overlaps; also, the impact to other audit process must be evaluated;
- Assessment of the quality of audit process results – the audit results are evaluations and recommendations included in the audit report; the quality of the results is established face of the audited organization satisfaction after the audit report implementation and audit process performing;
- Adequacy assessment of the measuring, monitoring and reporting system for audit effectiveness;
- Assessment of the direct and indirect impacts to establish whether the impacts are due to the audit investigation or to other cause;
- Identifying the factors prevent the IT&C audit performance or goal fulfillment;
- Analyzing the audit findings causes to identify the ways to make the IT&C audit programs more effective;
- Identifying the relative utility or alternative approaches to increase the effectiveness.

According to [12], the audit and evaluation processes are classified into the following classes:

- Regularity audit – aims compliance with the regulations;
- Economy audit – aims the economical use of resources;
- Efficiency audit – aims the proportionality between the employed resources and the results;
- Effectiveness audit – aims the consistency between the audit results and the audit objective;
- Evaluation of the audit consistency – aims the consistency between the employed resources and the goals;
- Evaluation of the audit impact – aims the economic and social impact of the audit investigation;
- Evaluation of the audit effectiveness and analysis of causality – established the source of causes for the observed results.

The following kinds of program evaluation in performance audit of the IT&C audit processes are adapted from [12]:

- Process evaluation – it establishes whether the audit activities are performed according to statutory and regulatory requirements, audit plan, professional standards and audit client expectations; the audit client expectations aim the quality issues of IT&C system used by organization in its business processes;
- Outcome evaluation – it represents the degree in which the IT&C audit plan achieves its objectives; the audit plan effectiveness is evaluated on the obtained objectives from the audit process implementation; also, the outcome evaluation leads to understand the ways in which the audit outcomes are produced;
- Impact evaluation – it assesses the effect of the IT&C audit process by comparing the audit outcomes with the estimated effect whether the IT&C audit process is absent; it is necessary to isolate the audit process contribution to the achieved outcomes;
- Cost-benefit and cost-effectiveness evaluation – the audit outcomes are compared to the audit process costs; cost-benefit analysis is made to identify the relevant costs and benefits; cost-effectiveness analysis is made to assess the cost to meet an objective and it can be used to identify cheaper alternatives.

To develop a performance audit investigation

of the IT&C audit processes, it is necessary to involve financial and performance evaluators in the performance audit team.

In order to develop a performance audit, assessment criteria must be defined to ensure a reliable, objective, useful, complete and accepted performance investigation of the IT&C audit processes. Criteria are standards to establish whether an audit process meets or exceeds the expectations [12].

Some possible source to define performance audit criteria are defined in [12] and adapted to IT&C audit processes:

- Laws and regulations applied in domain of the audited organization;
- Management decisions;
- Comparison with historical data and best practices;
- Professional standards, experiences and values;
- Key performance indicators established by the audited organization or audit client;
- Advice and know-how from independent experts;
- Using the scientific knowledge and other reliable information;
- Criteria used in previous performance audits or by performance audit teams;
- Similar organizations developing the similar performance audits;
- Performance standards or previous regulation requirements;
- Scientific literature.

Depending on the above sources, the criteria are classified into:

- Mandatory performance criteria – they are extracted from laws and regulations;
- Selective performance criteria – they are selected on basis of performance standards and performance experts skills.

The performance audit study is preceded by a pre-study. In pre-study, it is verified whether the conditions for a performance audit are met [12]. The audit proposal and the work plan are developed whether there are requirements to assess the performance of an audit process.

The performance audit plan aims, adapted from [12]:

- The audit report has potential users or other interested parties;
- Identifying the issues from previous or other audit processes that could affect the performance audit objectives;
- Considering the legal and regulatory environment;
- Establishing the studied problem topics, audited organization, audit objectives and the expected impact of the performance audit;
- Defining the questions and hypothesis to be tested;
- Establishing the performance audit criteria; the audit evidence is compared with the established criteria;
- Establishing the relevance, reliability and sufficiency of data within audited organization; also, data collecting is tested;
- Identifying the potential sources of information used to obtain performance audit evidence;
- Considering the help of consultants and other auditors; evaluation of the professional skills is important;
- Providing o comprehensive performance audit team;
- Considering the possible output and impacts of the performance audit.

The performance audit process is ended by a report. The audit report must meet the set objective and add value to the stakeholders. The performance audit report is distributed so to have a maximum impact on the audited processes. In decision-making of the report distribution, the following parties are considered: audited organization, performance audit client, mass-media, government institution and other interested parties.

In table 1, a methodology for performance evaluation of the IT&C audit process is provided.

Table 1. Methodology for performance evaluation, adapted from [12]

Stage	Content	Methods and Techniques
1. Planning the performance audit	Defining the possible issues of the performance audit from the following source: • Feasibility study; • Documents and interviews with stakeholders.	• Risk analysis; • SWOT analysis; • Problem analysis
2. Performance audit questions	Formulating the audit questions or defining the audit problem.	• Mind-mapping; • Brainstorming; • Discussions within the audit team; • Meetings with stakeholders and experts;
3. Study design	Establishing the necessary information to answer the audit questions.	• Goal-attainment studies or outcome based studies – achievement of the goals; • Process-based studies – the way in which the IT&C audit process works; • Impact studies – the effects of the IT&C audit process; • Cost-benefits and cost-effectiveness studies - establishing whether the benefits are greater than the costs and the goals are met using the lowest possible costs; • Meta-evaluation studies - evaluation and improvement of the assessment quality; • Other common studies - organizational studies, process and quality-management studies.
4. Performance audit program	Establishing the type o investigation.	• Comparative investigation - development trends and alternative conditions; • Before-After investigations – comparing the situation before performance audit and after carrying out the process; the impact is assessed on indicator values before and after; • Sampling investigation - depending on population size, question complexity, relevance and reliability of the questions; • Case study investigation – issues of real problems, analyses and comparison;

		• Quasi-experimental studies – a research design to simplify the impact assessment without a strictness using of the scientific tools.
5. Data collection	Selecting the techniques for data collection. Collected data have quantitative or qualitative form.	• File examination – examination of data depending on nature, location and availability of the files where data are stored; • Secondary analysis and literature search – is made on research reports, books and papers, studies in statistics and so forth; • Surveys of questionnaires - systematic collection of information from a defined population; • Interviews – question and answer session to gather specific information; • Seminars and hearings – bringing together specialist to acquire knowledge, discuss problems, observations and possible measures, different views and perspectives; • Direct observations – they are not common in performance audit.
6. Analyses of information	Exploring the explanations and relationships among audit results	• Descriptive statistics to understand data distribution – central tendency, spread of the data and shape of the data; • Regression analysis – degree of variable correlation.

The assessment system depicted in a previous chapter is used in the last step of the above methodology to make analyses regarding the performance of IT&C audit process. In a performance audit process, the auditing object is the audit process itself.

4 Conclusions

The performance indicators defined for the IT&C audit process of the distributed informatics systems are used to evaluate the quality of such audit processes. The performance levels are used to improve the audit processes and to increase the organization's income. This increasing is due to better recommendations of the performance audit that are implemented in future IT&C audit processes.

A performance audit process has its own organization model, with specific stages and activities to establish the performance goals and criteria for audit process improvements. The performance audit objective is accomplished when its results are better than the expected ones. Practically, establishing the performance levels means to compare the expected levels to the real ones. Also, it means to find the weaknesses of the analyzed process to find the ways to increase the expected performance levels.

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