Article

IT auditing quality assessment based on human, technical and contextual factors.

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Abstract: IT auditing quality has been defined by results obtained in the process. Meanwhile, multiple studies have been done to enhance it therefore, it continues to be a topic interest and research so it is worth mentioning that its quality relies on trained competent auditors and experts able to develop a process correctly, adapting to clients and to manage auditing inherent risks According to results from the IT audit, low quality and security levels have been identified in terms of the human, technical and contextual factors, affecting audit quality. The objective of this investigation is to identify metrics and to determine their own corresponding factor applying an exploratory type of research. In order to achieve such aim, a targeted survey was designed and implemented at the Institute of Internal Auditors of Ecuador since they have the knowledge and expertise in the field. A factor analysis statistics technique was applied to data gathered to verify that it relates to the identified factors as dimensions are reduced, thus the most impacting metrics may assess the quality of IT audits. Analysis results yielded a mean score for each one of the assessed metrics, concluding that the technical factor is the most significative since it relates roles and task performance during the auditing process as well as control procedures. Finally, most auditing quality-related issues are mainly the outcome of an inferior management auditing process, therefore it is crucial that collegiate groups and professionals in the field validate the auditing process.

Keywords: Quality; factor analysis; metric system

1. Introduction

Auditing quality is not an easy concept to define, and to date there is no concept universally recognized. However, it is linked to applicable standards to be audited [2]–[6]. Similarly, quality perception depends on the discretion of the team who are involved in the process. [7].

The most acceptable concept is the extent of success of the processes performed [8] and to avoid subjective quality in auditing results, the preferred methodology's inherent risk should be considered [9].

Furthermore ,auditing quality is defined based on the results yielded and despite several efforts to be enhance, it continues to be a subject worthy of attention and research [10]. Quality comes from qualified, motivated auditors in the correct design process adapting to the client so that inherent auditing risks are properly managed.

The first formal event to develop an auditing quality framework was performed by the Financial Reporting Council (FRC) in the UK in 2006. [11] Five auditing-quality drivers were identified: (1) An auditing firm's culture; (2) auditing partners and staff personal skills and qualities; (3) auditing effectiveness process; (4) reliability and auditing reports usefulness and (5) factors out of the auditors' hands affecting the auditing quality.

For and auditing process to be developed satisfactorily, it should be organized considering certain elements such as company size and its operations, the use of technology,

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resource availability and choice of auditing team and its competence. The auditing organization is considered as the responsible unit within a company in charge of auditing planning and proper fulfillment of the organizational objectives in regard to established standards. [8].

In this article, the concept of IT auditing quality is defined as the verification and validation process of results yielded from the monitoring exercise applied to analyze whether auditing products have pertinent criteria, opportunity and sufficiency, in addition to either adding value to the business or providing verified, independent objective information for the decision-making phase in the processing-related areas of the audited object.

Auditing quality results vary according to project conditions, meaning type of industry, audited company size, complexity of involved systems among others. [12], the quality revolves around key elements which altogether increase the likelihood of auditing enhanced efficiency and consistency [13]. Moreover, factors related to human, technical and contextual factors affecting the auditing quality are identified.

It is understood that a higher quality Audit is related to brand or specialized auditors in the industry, [11], [14], [15] claim that an auditor's experience, skills and specialized knowledge in the industry are positively related to audits quality. Outlined skills include communication and partnership, domain and process knowledge, professional development, personality traits as well as technical and auditing expertise and so on. Auditors should update clients data to provide effective auditing based on more detailed and relevant audit-testing [16].

Professional competence affects auditing quality, as auditors should have the expertise to interview, read quickly, understand statistics and computer use among other skills. On the other hand, accountability demonstrates that the auditor could have a satisfactory auditing performance, convinced that his work is carefully examined and verified by his supervisor who in turn is responsible to his employer. Thus accountability is decisive for the auditor since it affects the quality of the auditing process. [17].

In an study conducted by [18], the quality of the auditing was supported by two factors directly related to its performance. First, auditor's skills—expertise, knowledge, adaptability and technical efficiency--. Second, professionalism—able to work independently, objectivity, professional care, conflict of interest and judgement—.

The auditing environment is an additional quality- influencing factor, directly or indirectly [4], since it may have significative interactive effects in the auditing entry process. It has been discovered that many contextual characteristics influence the auditing quality such as auditor- partner fee, non-auditing additional fees and auditor continuity [11].

As the auditing results quality is influenced by several factors on premises, the low-quality and security issues are evident by the results from an IT auditing. Due to this fact, organizations are unlikely to obtain optimum results from decision-making processes aimed to enhance auditing processes.

The objective of this research work: i) To identify influencing quality results factors in IT auditing processes, ii) To understand group metrics in each factor.

To achieve these objectives, the study raises the following research questions:

1. What is the impact of influencing factors affecting the IT auditing process quality?
2. Which selected metrics for each factor influence auditing quality results?

2. Materials and Methods

The purpose of this research is to identify and define selected metrics so as to realize the emphasis of factors and its resulting metrics in auditing processes pursuing a greater approach in critical points within activities performed and results.

Since the study focuses on IT Auditing, the proposed approach was considered by [1] those analyzing a group of metrics affecting IT auditing processes quality. Next, it was supplemented with an exploratory investigation identifying potential factors and auditing quality-related metrics. After that, a targeted survey was designed and implemented

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on Internal Auditors of Ecuador who have the expertise to answer the survey. Then, A factorial analysis statistic technique was applied to the results gathered from the survey to verify that results are related to established factors in the bibliographical review, thus a dimension reduction occurs so that more impactful metrics assessing the quality of IT auditing results are obtained.

Potential metrics results are shown in Appendix A for a statistical analysis that determines whether they are grouped correctly allowing a dimension reduction based on its result.

A set of 94 metrics was validated by a group of academic experts in the auditing, IT auditing and engineering field to determine if the instrument is clear, precise and has a pertinent measuring scale and whether potential metrics are capable of achieving the objective in this study. Those surveyed responded on the basis of the seven-point Likert scale set from a totally low-to-totally high score to the following question What is each metric's extent of the impact on the quality of results from IT processes?

Next, an online survey was conducted and applied to Internal Auditors of Ecuador Institute specifically in the IT auditing and Information area. With a total of 475 registered answers the requirements are met so that a factorial analysis is developed, being considering that the minimum number of responses should be 100 [19]–[21], response rate to the number of metrics, considering 5:1 approach (5 responses per variable). software SPSS was used for the statistical analysis.

After that, a factorial analysis was performed to understand the relationship among metrics used in the survey so that a group of factors evidence most variability.

An internal consistency test through an Alfa de Cronbach was done, a reliability analysis to assess the metric-total correlation; scale reagents squared correlation and the reliability value if the reagent is eliminated. In this analysis, no reagent was eliminated since they have the same relation to the scale. All metrics keep the Alfa value = 0,997 for the 94 selected metrics (see table 1). As a general rule, one Alpha equal to 0.7 or higher represents a consistent set of variables.

Table 1. Reliability analysis- SPSS obtained results

Reliability Statistics	
Cronbach Alfa	**N° of elements**
0,997	94

Once the survey data consistency is checked, tests such as the Bartlett sphericity test were done to verify the significance of extracting factors from the set of metrics, which denotes that analyzed variables do not share a common variance. the Kaiser-Meyer-Olkin statistic (KMO) shows how much variance is present. For a factorization to be considered KMO index, values should be between ,70 - ,79 and satisfactory when its value is higher than 0,80 in which case a factorization is feasible providing key factors valuable data , by the degree in which each metric is predictable from others. [19].

Table 2 shows sphericity tests and KMO, where it is observed that the variable intercorrelation degree is strong confirming by the significance associated to the Bartlett sphericity test, that is 0,00 1. Similarly, KMO is 0,945 a value higher than 0,80, so according to this indicator, the data matrix is suitable to perform factorization.

Table 2. Bartlett sphericity test and KMO SPSS results

KMO and Bartlett tests		
Kaiser-Meyer-Olkin Sampling Adequacy Measurement		0,945
Bartlett sphericity test	**Aprox. Chi-square**	97784,441
	gl[1]	4371
	Sig. [2]	0,001

[1] Degree of freedom to obtain the observed significative value

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[2] Significance among variables

3. Results

Results include analyses for each metric from the survey to identify the ones affecting the quality of IT auditing and to observe how these metrics group into factors.

A score analysis was performed provided by those surveyed to verify the importance of each metric in the results phase, determining that metrics measurements vary from totally low, to totally high. As per consistency and approach [1], [22], in their research they focused on ten superior and inferior metrics considering an average score throughout the entire sample.

Table 3 shows the 10 highest scored metrics. Each element in the list is crucial when assessing the quality of auditing results since they hold a higher mean than 5.82, meaning that most of them had an IT auditing quality impact rating from medium to totally high.

Table 3. The ten best IT auditing quality rated metrics

N°	Survey Item	Overall average score
M45	Auditing results are totally supported by documents and evidence gathered in the auditing process	5,97
M26	The auditing team executes the audit impartially	5,89
M18	The auditor respects client's data confidentiality	5,89
M47	Auditing team achieves stated objectives in the auditing plan	5,89
M25	The auditing team demonstrates objectivity and integrity	5,87
M5	Members of the auditing team work on the auditing ethically and with transparency	5,86
M59	Audit report results are clear and concise	5,86
M87	Auditing team has the required permits to develop an auditing proces	5,86
M93	Auditing team is well informed regarding internal controls	5,85
M61	Report presentation performed under IT auditing standards, manuals, guidelines and practices.	5,83

In general, the best rated metrics focus on the auditor's objectivity, ethics, transparency, audit's objectives achievement and how results are presented compared to [1], those who found planning and fieldwork as the best rated metrics. This fact indicates similarity between IT auditing identified metrics and TI standards since they require a greater planning approach considering objectives set and achieved.

Table 4 presents the 10 lowest metrics mean, resulting in less than 5.49 then the auditing quality results impact is rated as average or totally low, still being somehow relevant. However, in comparison with higher rated metrics, these become insignificant. Lower rated elements suggest that the organizational structure from the audited institution and the auditor skepticism are unimportant regarding IT auditing, in line with what has been stated by [1] in the last item.

Table 4. Ten IT auditing lowest -quality rated metrics

N°	Survey Item	Overall average
M51	Client understands the purpose and process of IT auditing	5,48
M48	Findings, conclusions and recommendations were positively perceived by the client	5,48
M41	Auditing team uses documenting templates and forms	5,47

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M30	Auditor has national and international certifications from auditing and IT auditing field	5,47
M10	Auditing team has the client approval regarding tasks developed	5,45
M38	Auditor link-up to experts for support in the auditing process for results and client recommendations	5,44
M9	Auditing team ensures the client takes part in the auditing process	5,34
M15	Auditor has soft-skills—personal characteristics and competences that show the way he gets along with others	5,33
M80	The institution organizational structure reflected on the auditing plan	5,28
M31	Auditor is skeptic during the auditing process.	5,21

Similarly, a main component with varimax rotation analysis is carried out in order to perform a factorial varimax, simplifying factor interpretation. Factors having higher than 1 value are taken into account, while metric-factors have a larger than 0.6 cut since values are consistent with auditing-quality research done by [22] and [1]. Likewise, the orthogonally rotated factorial solution typify the existence of 5 latent factors and the contribution of each metric to the factor. As a whole, factors explain 84,754% variability in the original data as shown in table 5.

Table 5. Factorial analysis and item loads. Cells in bold represent the metric maximum while italics cells have a value lower than 0,6 therefore eliminated from the factorial analysis. Results obtained from SPSS

Métric	Factor				
	1	2	3	4	5
M1	*0,448*	*0,295*	*0,416*	*0,522*	*0,266*
M2	*0,362*	*0,349*	*0,486*	*0,378*	*0,362*
M3	*0,453*	*0,355*	*0,157*	*0,511*	*0,111*
M4	*0,502*	*0,454*	*0,284*	*0,571*	*0,022*
M5	*0,465*	*0,468*	*0,266*	*0,512*	*0,061*
M6	*0,441*	*0,376*	*0,376*	*0,565*	*0,147*
M7	*0,445*	*0,386*	*0,338*	*0,472*	*0,184*
M8	*0,448*	*0,430*	*0,424*	*0,513*	*0,154*
M9	0,253	**0,695**	0,417	0,418	0,328
M10	0,267	**0,612**	0,333	0,346	0,378
M11	0,334	**0,642**	0,507	0,374	0,178
M12	0,399	**0,692**	0,367	0,454	0,106
M13	*0,370*	*0,481*	*0,407*	*0,522*	*0,062*
M14	*0,393*	*0,546*	*0,408*	*0,474*	*0,025*
M15	0,364	**0,610**	0,451	0,311	0,160
M16	0,417	**0,677**	0,346	0,340	0,174
M17	0,462	**0,651**	0,341	0,369	0,051
M18	*0,432*	*0,582*	*0,330*	*0,492*	*-0,013*
M19	0,418	**0,685**	0,348	0,324	0,098
M20	0,395	**0,696**	0,436	0,309	0,230
M21	0,363	**0,613**	0,362	0,486	0,102
M22	0,389	**0,626**	0,397	0,329	0,109
M23	*0,347*	*0,486*	*0,481*	*0,343*	*0,204*
M24	0,407	**0,668**	0,386	0,436	0,123
M25	*0,425*	*0,492*	*0,412*	*0,557*	*0,060*
M26	*0,456*	*0,445*	*0,406*	*0,578*	*0,004*

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M27	0,399	**0,626**	0,396	0,418	0,115
M28	0,438	**0,602**	0,330	0,399	0,040
M29	0,433	**0,612**	0,343	0,436	0,032
M30	0,383	**0,611**	0,327	0,302	0,327
M31	*0,326*	*0,543*	*0,225*	*0,014*	*0,262*
M32	*0,427*	*0,526*	*0,272*	*0,247*	*-0,086*
M33	0,360	**0,759**	0,294	0,290	0,040
M34	0,438	**0,731**	0,239	0,328	-0,062
M35	0,392	**0,721**	0,324	0,248	0,114
M36	0,481	**0,673**	0,282	0,311	-0,030
M37	*0,386*	*0,540*	*0,360*	*0,150*	*0,148*
M38	0,342	**0,746**	0,294	0,218	0,107
M39	0,461	**0,704**	0,295	0,274	-0,101
M40	0,424	**0,713**	0,283	0,368	0,005
M41	**0,632**	0,436	0,213	0,362	0,145
M42	*0,528*	*0,431*	*0,268*	*0,434*	*0,047*
M43	**0,704**	0,420	0,207	0,295	0,132
M44	**0,608**	0,483	0,307	0,309	0,204
M45	**0,634**	0,428	0,285	0,446	0,074
M46	**0,659**	0,521	0,331	0,244	0,133
M47	*0,571*	*0,428*	*0,320*	*0,391*	*-0,008*
M48	**0,635**	0,275	0,329	0,378	0,187
M49	**0,741**	0,341	0,319	0,307	0,092
M50	**0,633**	0,427	0,256	0,354	0,169
M51	**0,646**	0,317	0,334	0,148	0,364
M52	**0,661**	0,371	0,413	0,293	0,255
M53	**0,691**	0,425	0,322	0,318	0,087
M54	**0,719**	0,397	0,315	0,349	0,024
M55	**0,702**	0,387	0,318	0,280	0,214
M56	**0,675**	0,401	0,308	0,382	0,127
M57	**0,654**	0,423	0,414	0,132	0,276
M58	**0,679**	0,388	0,450	0,182	0,146
M59	**0,720**	0,361	0,355	0,296	0,117
M60	**0,687**	0,384	0,403	0,269	0,157
M61	*0,507*	*0,364*	*0,354*	*0,358*	*-0,011*
M62	**0,676**	0,437	0,383	0,256	0,100
M63	**0,677**	0,428	0,389	0,242	0,186
M64	*0,568*	*0,310*	*0,380*	*0,396*	*0,030*
M65	**0,721**	0,331	0,403	0,272	0,141
M66	**0,703**	0,346	0,400	0,237	0,169
M67	**0,665**	0,334	0,444	0,231	-0,004
M68	**0,697**	0,393	0,416	0,303	0,040
M69	**0,666**	0,369	0,303	0,349	-0,009
M70	*0,502*	*0,394*	*0,392*	*0,304*	*-0,061*
M71	**0,696**	0,362	0,422	0,327	0,078
M72	**0,710**	0,384	0,417	0,263	0,084
M73	**0,702**	0,403	0,445	0,224	0,040
M74	**0,701**	0,397	0,407	0,248	0,037
M75	**0,692**	0,382	0,408	0,202	0,208
M76	**0,696**	0,377	0,408	0,254	-0,030
M77	**0,688**	0,399	0,432	0,266	0,038
M78	**0,656**	0,414	0,417	0,345	0,032

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M79	**0,698**	0,329	0,458	0,280	0,018
M80	*0,387*	*0,275*	*0,582*	*0,114*	*0,115*
M81	0,455	0,324	**0,625**	0,298	0,084
M82	0,423	0,367	**0,698**	0,189	0,093
M83	0,446	0,328	**0,683**	0,247	0,208
M84	0,425	0,377	**0,670**	0,214	0,266
M85	*0,507*	*0,399*	*0,591*	*0,307*	*0,104*
M86	0,475	0,413	**0,638**	0,253	0,032
M87	*0,513*	*0,355*	*0,599*	*0,294*	*0,030*
M88	0,461	0,319	**0,624**	0,272	0,108
M89	*0,517*	*0,375*	*0,528*	*0,376*	*-0,104*
M90	*0,451*	*0,340*	*0,519*	*0,370*	*0,022*
M91	*0,510*	*0,382*	*0,596*	*0,335*	*-0,147*
M92	0,459	0,414	**0,667**	0,251	0,057
M93	*0,408*	*0,351*	*0,505*	*0,389*	*0,024*
M94	*0,507*	*0,352*	*0,594*	*0,372*	*-0,042*

Metrics not meeting the analysis value such as lower to 0,6 are eliminated from the analysis while elements lacking of load value are: M1, M2, M3, M4, M5, M6, M7, M8, M13, M14, M18, M23, M25, M26, M31, M32, M37, M42, M47, M61, M64, M70, M80, M85, M87, M89, M90, M91, M93, M94.

Finally, the ultimate analysis instrument is comprised by 64 reagents that, reanalyzed are grouped into 3 factors matching the analyzed theory in [23]. Factors are solid representations of a previously studied theoretical component, consequently the factorial analysis should identify a set of reagents for abstract-concepts since factors matching theoretical basis means positive validity evidence [1], [20], [21], [24]. Identified factors are labeled as human, technical and contextual according to the theoretical basis. The final analysis solution converged in new iterations explaining 83.788% variance. Items reveal factorial loads higher than 0,6 within its own factor and communalities higher than 0,694 ordered from highest to lowest, grouped in 3 identified factors as shown in Table 6.

Table 6. Final solution factorial analysis and metric loads. Bold cells represent the maximum load while the factor belonging to the reagent. Results obtained from SPSS

Métrica	**Factor**		
	1	**2**	**3**
	Técnico	**Humano**	**Contextual**
M49	**0,789**		
M65	**0,764**		
M59	**0,758**		
M54	**0,757**		
M72	**0,757**		
M79	**0,750**		
M66	**0,749**		
M71	**0,745**		
M55	**0,742**		
M76	**0,742**		
M43	**0,739**		
M74	**0,738**		
M73	**0,736**		
M68	**0,728**		
M53	**0,725**		
M60	**0,724**		
M56	**0,720**	0,512	

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M69	**0,719**		
M77	**0,719**		
M75	**0,718**		
M58	**0,716**		
M67	**0,714**		
M62	**0,712**		
M63	**0,703**		
M78	**0,703**		
M52	**0,697**		
M45	**0,695**	0,555	
M48	**0,686**		
M41	**0,681**	0,528	
M46	**0,679**	0,554	
M51	**0,677**		
M50	**0,670**	0,509	
M57	**0,669**		
M44	**0,638**	0,554	
M40		**0,792**	
M33		**0,791**	
M38		**0,775**	
M34		**0,774**	
M39		**0,750**	
M35		**0,748**	
M19		**0,743**	
M36	0,524	**0,734**	
M17	0,515	**0,730**	
M29		**0,716**	
M12		**0,711**	
M24		**0,702**	
M10		**0,696**	
M28		**0,692**	
M21		**0,677**	
M15		**0,672**	
M30		**0,668**	
M27		**0,656**	
M20		**0,646**	
M16		**0,644**	
M22		**0,632**	
M9		**0,628**	
M11		**0,623**	0,527
M83			**0,715**
M84			**0,708**
M82			**0,677**
M92	0,520		**0,656**
M81	0,515		**0,634**
M88	0,530		**0,622**
M86	0,535		**0,606**

4. Discussion

Each auditing process is unique and success depends on the circumstance and factor-selection. Additionally, its metrics should support development and practice of the process. [12], [13]. Likewise, auditing quality revolves around key factors identified in the

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research. It is summarized that this process should be designed by highly trained and motivated auditor sable to appreciate technical, contextual or environmental factors that adequately adjust to individual auditing conditions in each audit.

Technical Factor

Related to the auditing performance activities during the process including organization, strategy and planning, methodology selection, field work, results and reports, evidence based on decision-making processes, quality control and auditing improvement. Most quality-related issues are mainly the result of unacceptable auditing management process [13] as it depends on specific aspects in the auditing process and control procedures. [11].

Within the auditing process a choice of tools, techniques, methodologies and specific methods in the auditing team will follow. Some metrics from this factor are: the use of project management ultimate practices, field work review, planning, project scope, audit impact, auditing practice and procedures and the like. [4], [12].

Human Factor

Addresses the auditor or auditing professionals, client or the audited, management and key interactions of all involved in the process. It is important to consider quality perception through every participant—users, auditors, regulators and society- [25], since they have different views in regards of what constitutes and has an effect on the type of metrics used to assess the auditing quality.

The auditor or group of professionals in the audit, depending on the circumstance are responsible for the performance of an audit [13] and the result of their work will successfully reflect on a reliable audit report based on established standards. [17]. Given that experienced auditors follow standards well, are therefore associated to the unlikeliness of audit failure [26]. All these qualities lead to adequate planning and auditing programs generating reliable results which may directly affect client satisfaction, crucial when evaluating quality[6].

Contextual Factor

Related to external auditor elements and the auditing process, to include social and institutional force from both, the audited institution and the auditee, their regulatory environment and resource management.

Additionally, the environment in which auditing processes are carried out varies from one country to another. As a country develops and companies become larger, more security is particularly needed regarding internal processes as the environment turns more complex. As a consequence, laws, security requirements and corporate government processes, the estate of the laws and auditing inspections or when research fails the process and adoption of disciplinary measures become more effective if they are fulfilled apappropriately. [4] Thus, management and institution resource optimization should be considered upon strategy implementation so as to decrease costs for both, the auditee and the audited company [27]. Altogether, these contextual factors have the potential to affect directly or indirectly the nature of the auditing since they have significative interactive effects on the entries and auditing process [4].

In addition to perform the factorial analysis and to evaluate resulting factors, the impact each factor had on the auditing quality results was assessed and scores are calculated for each factor based on the corresponding metrics average. Table 7 shows each factor mean, variance and the number of metrics pertaining to each factor.

Table 7. Statistics per factor.

Factor	Mean	Variance	Elements
1. Technical	193,08	2167,371	34
2. Human	127,97	940,014	23

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3. Contextual	39,58	91,235	7

The three affecting quality factors from the auditing results, the technical factor is the most significative due to the number of metrics found in its factor load, which is superior compared to the other two factors. Regarding the dimension reduction process, the technical factor revealed minimum-reduction totaling 5 discarded metrics: M42- Auditing team has approval methods for completed tasks in the auditing process., M47- Auditing team achieves planned objectives, M61-Reports presentation is done under IT auditing policies, standards, manuals, guidelines and practice, M64-Auditing team is has ample knowledge of auditing evidence gathering techniques and M70-Auditng plan developed according to IT auditing policies, standards, manuals, guidelines and practice

On the other hand, in the human factor 17 metrics were eliminated: M1-the leader of the auditing team or individual possesses leadership qualities, M2.-The representative for the organization which is being audited possesses leadership qualities, M3-Personnel who performs the auditing process has ample auditing experience, M4-Auditing team members demonstrate honesty and respect while doing their job, M5-Auditing team members work on the auditing ethically and transparently, M6- Auditing team keeps a cordial and respectful relationship with the auditee both verbally and in writing, M7- Auditing team fulfills client requirements, M8-Audtior knows how to listen and is receptive to the client, M13-Personnel performing the auditing has the ability to deal with sensitive situations, M14- Personnel performing the auditing demonstrates assertiveness in problem solving and demanding situations, M18-Auditor respects client confidentiality and information M23-Auditor reports to the person in charge events that may affect his independence, M25-Auditing team displays objectivity and integrity, M26-Auditng team executes the auditing impartially, without prejudice, M3- Auditor is skeptic during the auditory process, M32-Auditing team's expertise adds value to the auditee,M37-Auditing team holds regular formal and intelligible meetings for analysis progress and results.

As per contextual factor, 8 metrics: M80-An institution organizational structure is reflected in the auditing plan, M85-Auditor team present recommendations to the organization regarding international standards, local regulation, strategic objective updates as well as changes in the auditing environment, M87-Auditing team has all the required permits to develop the auditing process, M89-Auditing team is prepared to the risk of litigation, M90-Auditing team has access to human and technical resources for specialized audits, M91-Auditing team has access to required resources to comply with the scope and auditing calendar, M93-Auditing team is well aware of internal controls and M94-Auditing team identify client internal control system key elements, resulting in IT auditing quality-result evaluation tool comprised by 64 metrics.

5. Conclusions

At present, IT auditing is one of the fields taken very seriously, unfortunately there are not enough process authenticators, resulting in quality deficient audits caused by several internal and external factors.

Likewise, it can be concluded that IT auditing processes lack quality owing to deficiencies within the auditing process as well as management performed by incompetent auditors attributable to the absence of technology training and the use of data advanced techniques. Despite that auditing firms make great efforts to train their personnel it is possible to realize that only a few auditors are able to take on new challenges.

In this study, quality-affecting factors were pinned down, analyzed and compared to existent theoretical foundation, same that were categorized by technical, human and contextual factors.

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Based on the study performed, two factors were ruled-out that, according to the analysis have no significance in the IT auditing process exhibiting a deficiency of higher than 0,6 factorial loads, making the technical factor the most significative in IT auditing processes as it was the factor reveling less dimensions reduction plus a factorial load superior to human and contextual factors.

To conclude, it can be determined that by applying technical, human and contextual factors and resulting significant metrics there is an improvement in the IT auditing quality assessment process.

6. Patents

Author Contributions: For research articles with several authors, a short paragraph specifying their individual contributions must be provided. The following statements should be used "Conceptualization, D.I. and L.S.; methodology, D.I. and L.S.; formal analysis, D.I. and L.S.; investigation, D.I. and L.S.; resources, J.D. and T.S.; data curation M.O.; writing—original draft preparation, S.A.; writing—review and editing, D.I., L.S.; visualization, J.D. and M.O.; supervision, D.I.; project administration, D.I.; All authors have read and agreed to the published version of the manuscript." Please turn to the CRediT taxonomy for the term explanation. Authorship must be limited to those who have contributed substantially to the work reported.

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Appendix A

IT Auditing Quality metrics

Code	Metric	Source
M1	Auditing team leader or indiviual possesses leadership skills	[10], [28]
M2	The (auditee)organization's representitive possesses leadership skills	[10], [28]
M3	Personnel peforming the audit has ample auditor experience.	[1], [3], [4], [11], [12], [14], [15], [17], [26]
M4	Auditing team members demonstrate honesty and respect when doing their job.	[4], [10], [17]
M5	Members of the auditing team peroform ther audit ethically and transparently.	[4], [10], [17]
M6	Auditor team keeps a cordial and verbal and written respectful relationship with the auditee	[1], [11], [12]
M7	Auditing team fulfills client requirements	[1], [11], [12]
M8	Audtior knows how to listen and is receptive to the client	[1], [11], [12]

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M9	Auditing team makes sure the client takes part in the entire auditing process	[1], [11], [12]
M10	Auditing team has client approval of the tasks developed	[1], [11], [12]
M11	Auditing team and client direct efforts to a common goal	[1], [11], [12]
M12	Personnel performing the audit the requiered competene to perform their job	[5], [10], [12], [17], [28]
M13	Auditing personnel has the ability to deal with sinsitive situations	[5], [10], [12], [17], [28]
M14	Auditing peronnel exhibits assertivemeness in problem solving and demanding situations	[5], [10], [12], [17], [28]
M15	Auditor possesses soft skills –personal characteristics and competencies that demonstrate the auditor gets along with others—	[5], [10], [12], [17], [28]
M16	Auditing personnel effective suggestions to the institution to be audited	[5], [10], [12], [17], [28]
M17	Auditing personnel has observation skills	[5], [10], [12], [17], [28]
M18	Autditor respects client information and confidentiallity	[4], [10]
M19	Auditor keeps an open mind when new ideas are suggested	[4], [10]
M20	Auditor is confident of himself and his job	[4], [10]
M21	Auditing team continues being independent in appereance and action	[1], [28], [29]
M22	Auditing team does not get involved in activies that compromise their independence	[1], [28], [29]
M23	Auditor reports to the person in charge events that may affect his independence	[1], [28], [29]
M24	Auditing team foceses on facts	[13], [17], [29]
M25	Auditin team demonstrates objectivity and integrity	[13], [17], [29]
M26	Auditing team executes the audit impartially and with no prejudice	[13], [17], [29]
M27	Auditing team is supported to reach their goals	[17]
M28	Auditing team demonstrates a great deal of effort to perform the audit	[30]
M29	The auditor is concerned for his training and continuing training	[26]
M30	Auditor has national and international certifications in the auditing and IT auditing field	[26]
M31	Auditor exhibits skepticism during the entire auditing process	[4], [5]
M32	Auditing team expertise add value to the auditee – the organization—	[1], [4], [15]
M33	Members of auditing team demonstrate conficedence regarding information security and data processing	[1], [4], [15]
M34	Clients disputes are dealt with appropriately and objectively	[4], [12]

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M35	Auditing team is available to attend to clients inquiries	[4], [12]
M36	Those involved in the audit keep frequent communication	[4], [12]
M37	Auditing team hold regular formal intellible meetins for analyses progress and results	[14]
M38	Auditor link up with experts as asupport in the auditing process to obtian client recommendations and results	[12]
M39	Auditing team appropriately selects consultants and experts	[12]
M40	Auditor follows policies and procedurtes that regulate ethical and professional compliance	[27], [31]
M41	Auditing team uses templates and forms to document the process	[10]
M42	Auditing team has approval procedures for completed auditing tasks	[10]
M43	Auditor and those responsible for the organization - auditee- follow up on auditing previous IT audiging issues	[10], [28]
M44	Audit findings and conclusions are an exact reflexion of the audited process real facts	[13], [29]
M45	Auditing results are totally supported and documented by auditing gathered evidence	[13], [29]
M46	Members of the auditing team and those responsible for the institution protect at all times information used in the process	[29]
M47	Auditing team achieves objectives planned in the auditing	[13], [29]
M48	Findings, conclusions and recomemendations were positively approved by the client	[13], [29]
M49	Auditing assigned resources go accordingly to audit relevance and complexity	[13], [29]
M50	System, process and audited subject is important to the organization	[13]
M51	Client understands the process and purpose of the IT auditing	[13]
M52	In the scope, all required elements for a successful audit are addressed	[1], [13], [18]
M53	Audit execution complies with the elements agreed in the scope	[1], [13], [18]
M54	Results are delivered in the appropriate and established time	[13]
M55	Risk evaluating model is comprehensive	[5], [11], [12]
M56	Auditing plan takes into account client-related risks	[5], [11], [12]
M57	Auditing team is committed to the auditing completion deadline	[3], [4], [12]
M58	Auditing process is developed accurately	[4]
M59	Results from the auditing report are clean and concise	[4], [10], [11], [13]

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M60	Scope, findings and recommendations are undertendable for anyone that makes use of the audit report	[4], [10], [11], [13]
M61	Reports presentation is done under policies,standars, manuals, practice and IT guidelines	[4], [10], [11], [13]
M62	Auditing team performs fieldwork adequately	[1], [4], [18]
M63	Auditing is executed under IT auditing policies, standards, manuals, guidelines and practice	[1], [4], [18]
M64	Auditing team is has ample knowledge of auditing evidence gathering techniques	[1], [4], [18]
M65	All tasks are developed according to planned	[1], [4], [18]
M66	Verification lists are completed, aproved and documented	[1], [4], [18]
M67	Workfield is checked by an expert	[1], [4], [18]
M68	Clilent or those responsible for the organization provide data gathering support	[1], [18]
M69	Information and results from previous audits are available for revision	[1], [18]
M70	Auditing plan is developed according to IT auditing policies, standards, manuals, guidelines and practice	[1], [18]
M71	Objectives and auditing scope are appropriately specified	[1], [18]
M72	Auditing tasks and tools are clerly described	[1], [18]
M73	Auditing team memebers have a clear and coherent undestanding of the auditing plan	[1], [18]
M74	Budget and audit schedule are set up adequately	[1], [18]
M75	Required resources to perform the auditing are evaluated	[1], [18]
M76	Personnel and equipment required assigend by the auditing are evaluated	[1], [18]
M77	Auditing plan is addressed, made, checkedand approved by supervisors and those responsible for the organization and auditing team members	[1], [18]
M78	Auditing team uses IT auditing metodology to plan, manage and develop audits	[1], [12]
M79	Auditig team uses technological tools and updated methodologies to perform their job	[1], [12]
M80	An institution organizational structure is reflected on the auditing plan	[1], [4], [10], [12], [18]
M81	Auditor promotes through his an organizational culture based on IT security good practice	[1], [4], [10], [12], [18]
M82	Auditing team follows strict quality procedures	[4], [5], [11]
M83	The auditing team leadaer is commited to quality control systems	[4], [5], [11]
M84	Norms and regulations issued by control organisms are reflected on auditing plans	[4], [12]
M85	Auditing team presents recommendations that the organization should follow because of international standard updates, local regulation,	[4], [12]

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	strategic objectives and change in the auditing enviroment	
M86	Auditing team is knowledgeable in terms of relevant information of the laws and regulations that may have a significant impact on audit objectives	[4], [12]
M87	Auditing team has the required permits to develop and auditing process	[4], [12]
M88	Disciplinary measures are applied in case of auditing plan or current regulatory legal standards non-compliance	[4], [12]
M89	Auditing team es fully prepared before the risk of litigation	[4], [28]
M90	Auditing team has acces to technical and human resources for an specialized audit	[18]
M91	Auditing team has access to required resources to comply with the scope and auditing calendar	[18]
M92	Audit cost commesurate with tasks developed and complexity	[11], [15], [28]
M93	Auditing team is well aware of internal controls	[28]
M94	Auditing team identify client internal control system key elements	[28]

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